CITY OF DELRAY BEACH

TECHNICAL SPECIFICATIONS

Pompey Park Rec Center

ITBC No. 2023-062

PROJECT #: 16-102

November 24th, 2025

POMPEY RECREATION CENTER
TECHNICAL SPECIFICATIONS
EXHIBIT A

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SECTION 010100 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Project Information
2. Work covered in Construction Documents and Specifications Project Manual
3. Security Requirements
4. Type of the Contract.
5. Required Vendors
6. Work Restrictions
7. Limits of Construction
8. Products Supplied By Others
9. Coordination of Work
10. Cooperation Between Contractors
11. City Occupancy
12. Time for Performance
13. Discrepancies, Interpretation and Omissions
14. Permits and Fees
15. Job Site Visitation
16. Utility Location
17. Definitions
18. Extended Warranty

1.3 PROJECT INFORMATION

A. Project Identification: Pompey Park Recreation Center

B. Project Location: 1101 NW 2nd St, Delray Beach, FL 33444

C. Owner: City of Delray Beach.

1.4 WORK COVERED BY THE CONSTRUCTION DOCUMENTS

A. The Work generally includes Design, Permitting, and Construction of the following items:

1. Building structures
2. Bleachers
3. Pools (Family Pool and Competition Pool)
4. Pool features and equipment
5. Building – Pump rooms.
6. Parking Improvements (All new parking and underground structures)

7. Specialty Equipment
8. Access Control System
9. Audio / Visual System
10. Telephone System (Infrastructure to receive City Phone System)
11. Site Improvements
12. Site Utility Connections.
13. Landscaping and Irrigation System
14. BDA System
15. Vertical Transportation. Elevators
16. All Items noted in the Construction Documents.
17. All Items required to meet Specified Codes, References, and Standards.

1.5 SUSTAINABLE BUILDINGS – FLORIDA GREEN BUILDING COALITION (FGBC) MIN. SILVER RATING AS A GOAL

1.6 TYPE OF CONTRACT

A. Project will be constructed under a single Construction Manager at Risk (CMAR). Guaranteed Maximum Price (GMP). Project will have two Notices To Proceed. NTP-1 will authorize work for Phase 1A, 1B, 2C. Certificate of Occupancy for the new Building and move to the new building will be required prior to the City issuing NTP-2 for Phase 2A, 2B, 2C.

1.7 REQUIRED VENDORS

A. Construction Manager will be required to coordinate and contract work with ADT for Security Equipment, Access Control System with Headend, Burglar Alarm System, Video System with Headend, Intrusion System with Headend, DBA System, IDF Closet, including UPS unit and Network Switches, Panic Button Wireless System, the Panic Button System, and Cabling infrastructure to support the system. Construction Manager is responsible to provide, construct and cover all items, all scope, work noted on Construction Documents. Construction Manager should include in his bid and contract all work if not specific noted not be provide by a specific vendor or subcontractor. All work and scope in Construction Documents must be included by the Construction Manager in bid.

1.8 WORK RESTRICTIONS

A. Work hours shall comply with the Project Schedule requirements. Work may proceed from 7am to 6pm, on weekdays and non-holidays, Saturday 8am to 4pm. See General Conditions Division 0 Section 7 and follow City of Delray Beach guidelines per chapter 99 – noise control.

B. Nonsmoking Building: Smoking is not permitted within the building or within 75 feet of entrances, operable windows, or outdoor air intakes any time during the construction phase.

1.9 LIMITS OF CONSTRUCTION

A. The work set forth in the Construction Documents will be performed within the limits established in the site plan and construction staging drawings provided by Construction Manager. Construction Manager shall not work outside of the limits without requesting authorization in writing and receiving written approval from City and Architect.

1.10 PRODUCTS SUPPLIED BY OTHERS

A. City of Delray Beach reserves the right to direct purchase selected items directly from a manufacturer or vendor, pursuant of section 212.08 (6), Florida Statues for the Pompey Park Rec center project.

B. Items furnished by City for installation by City:

1. The City may award various contracts for purchasing and installing specified materials. The Construction Manager shall cooperate, also coordinate with the City independent contractors and provide access to the work areas as necessary.

C. Items furnished by City for installation by Construction Manager:

1. The City may award various contracts for purchasing and installing specified materials. Material lists from those purchase contracts will be provided to the Construction Manager. The Construction Manager shall coordinate, receive, inspect, unload specified materials from the transporter, transport to secure storage, and load, deliver the materials to the site for installation / incorporation into the project.

1.11 COORDINATION OF WORK

A. The Construction Manager shall be responsible for the planning and scheduling, and coordination of all Work performed under the Construction Documents and Specs, so that materials will arrive on schedule and installation will proceed without delay. Reference proposed project schedule to be provided by City or A/E Professional and/or Owners Representative.

B. Coordinate scheduling, construction, submittals, and Work of the various Sections of specifications to assure efficient and orderly sequence and installation of interdependent construction elements. Includes vendors hired or selected by City.

C. Verify that the utility requirement characteristics of operating equipment are compatible with available utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements and installation of Work, which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of runway. Utilize spaces efficiently to maximize for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean up of work of separate Sections in preparation for Substantial Completion.

G. After City occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with the Contract Documents, to minimize disruption of City, operator or activities.

H. Coordinate Utility installation with each utility provider. All utilities, including gas service and communication.

1.12 COOPERATION BETWEEN CONTRACTORS

A. One or more contracts may be required to construct the project. When separate contracts are awarded for different portions of the project, the Construction Manager in each case shall be the person other than the City who signs each separate contract.

B. The City reserves the right to contract for and perform other or additional construction on or near the Work covered by this Contract.

C. When separate contracts are let within or near the limits of the Project, the Construction Manager shall conduct its Work so as not to interfere with or hinder the progress of completion of the construction performed by other Contractors. Contractors working on the same Project shall cooperate with each other as directed and coordinated by Construction Manager (master permit).

D. The Construction Manager shall assume all liability, financial or otherwise, in connection with this Contract and shall protect and save harmless the City from any and all damages or claims.

E. The Construction Manager shall arrange its Work and shall place or dispose of the materials being used as not to interfere with the operations of the other Contractors within or near the limits of the Project. The Construction Manager shall join its Work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

1.13 CITY OCCUPANCY

A. The City will occupy the facility and limited areas adjacent to the site including front entrance parking and roadways during the entire period of construction.

B. The surrounding properties are in use 24 hour / day, 7 days / week. The Construction Manager is required to perform the needed work for his construction effort in a way that does not disturb the function or interrupt ongoing operations. All work must be coordinated and schedule with approval from City staff. The areas not covered by the work must be protected. Any areas damaged or disturbed by the construction effort in any way must be repaired and brought to the condition it was found just prior to the construction. All repairs must be done by the Construction Manager as part of this contract and to the complete satisfaction of the City.

1.14 TIME FOR PERFORMANCE

A. The work to be performed under this Contract shall be commenced upon issuance of the Notice to Proceed.

B. The time limits stated in the Construction Documents & Specs are the essence of the Contract. By executing the Agreement, the Construction Manager confirms that the Time for Completion is a reasonable period for performing the work. The Construction Manager shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the time for completion.

C. The Construction Manager, having vast experience in the construction of improvements in South Florida, recognizes that unforeseen conditions occur and that as a normal course of construction there may be rain days, difficulties in obtaining materials and labor, requests for information from the Construction Manager to the City or A/E Professional and/or Owners Representative, submittals, shortages and inefficiencies in operations. These will not be considered excusable delays.

D. Time is of the essence for this Contract. Construction Manager shall strictly adhere to the project schedule and limitations noted in schedule.

NTPs and Time of Performance

Two (2) NTPs shall be issued for the project. NTP-1 for scope of work under Phase 1A, 1B, 1C and NTP-2 for scope of work under Phase 2A, 2B, 2C.

1. Final Completion shall be within five hundred seventeen (517) calendar days for Phase 1A, 1B, 1C. Substantial Completion shall be obtained sixty (60) calendar days prior to Final Completion.

2. Final Completion shall be within three hundred nineteen (319) calendar days for Phase 2A, 2B, 2C. Substantial Completion shall be obtained forty-five (45) calendar days prior to Final Completion.

E. City will impose Liquidated Damages, per the contract terms and conditions, for any delays, beyond excusable extensions, to the project schedule.

F. In addition to the Liquidated Damages, Construction Manager shall be responsible for paying all A/E Professional and/or Owners Representative additional service fees required to administer the project beyond the schedule specified.

1.15 DISCREPANCIES, INTERPRETATION AND OMISSIONS

A. Construction Manager shall bring any apparent discrepancies to the attention of the Owner / A/E Professional and/or Owners Representative with minimum 15 days for response prior to commencing with the Work. Construction Manager shall use a Request for Information (RFI) form to communicate discrepancies and receive direction.

B. Should conflict occur between the Specs, Shop Drawings, and the Construction Documents, the Construction Manager is deemed to have based the bid upon the more expensive method of performing the Work.

1.16 PERMITS AND FEES

A. Construction Manager shall obtain all permits.

1. City will pay for City of Delray Beach Permit fees. Review / Permit fees for all other agencies and all re-inspection fees will be paid by the Construction Manager.

2. All impact fees to the County or other agencies will be paid by the Construction Manager and reimbursed by City of Delray Beach.

1.17 JOB SITE VISITATION

A. Job site visitation is mandatory; submission of a Proposal will be construed that the Construction Manager is acquainted sufficiently with the work to be performed.

1.18 UTILITY LOCATION

A. All underground utilities lines must be located by the Construction Manager prior to any excavation or earthwork. Construction Manager must hand dig and confirm location of existing lines marked by utility locate company.

B. Any existing underground utility lines damaged by the Construction Manager during the course of construction must be promptly repaired or replaced at the Construction Manager's expense and at no additional cost to the City. At the sole discretion of the City, such repairs shall be performed by the Construction Manager's forces or by another Contractor retained by the prime Construction Manager. Any delays ensuing from this damage will be considered inexcusable and the City will have the right, at the City's sole discretion, to hire a Contractor and to back charge the Construction Manager if the work is not done in a timely manner.

C. It shall be the Construction Manager 's responsibility to verify all existing utility locations. The A/E Professional and/or Owners Representative and the City take no responsibility or liability for any existing conditions.

1.19 DEFINITIONS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the work. Products may also include existing materials or components required for reuse.

B. Furnish: To supply and deliver, unload, inspect for damage (same as supply).

C. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, and make ready for use.

D. Provide: To furnish or supply, plus install.

E. Supply: To supply and deliver, unload, inspect for damage (same as furnish).

1.20 EXTENDED WARRANTY

A. Construction Manager shall fully warrant the entire project for a period not less than one (1) year from date of the Substantial Completion. All major equipment, as defined below, shall be warranted in the base bid for a period not less than five (5) years or as specifically noted in Construction Documents.

1. Major Equipment shall include:

a. Mechanical - Air Handlers, Exhaust Fans, Fresh Air Units, Energy Recovery Units, Mini-splits pool pump system with controls and monitoring systems.

b. Electrical - Panels, Switchgear, Generator, Automatic Transfer Switches, UPS, Transformers, LED lighting boards and controllers.

c. Plumbing – Pumps and controls

d. Conveyance - Elevators

e. Site and Sports lighting

f. Score Boards for Gymnasium and Competition Pool.

g. Geothermal equipment.

h. Pool equipment and pumps.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 011410- MATERIALS TESTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROCEDURE

A. Testing Agency: An independent testing agency shall be provided by the Construction Manager to inspect and test the materials and methods of construction as specified for compliance with the specification requirements of the Contract Documents.

1.3 QUALIFICATIONS OF TESTING AGENCY

A. The Testing Agency selected shall meet the basic requirements of ASTM E329 "Standard of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction."

B. The Testing Agency selected shall meet "Recommended Requirements for Independent Laboratory Qualification," latest edition, as published by the American Council of Independent Laboratories.

C. Testing machines shall be calibrated at intervals not exceeding 12 months by devices of accuracy traceable to the National Bureau of Standards or accepted values of natural physical constants.

D. Tests and inspection shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.

1.4 AUTHORITIES AND DUTIES OF THE TESTING AGENCY

A. Reviewing Drawings and Specifications: The Testing Agency shall obtain and review the project plans and specifications. The Agency shall attend site meetings to coordinate materials inspection and testing requirements with the planned construction schedule.

B. Notification of Deficiencies in the Work: The agency shall notify the Project Manager, Professional and Construction Manager first by telephone and then in writing of observed irregularities and deficiencies of the work and other conditions not in compliance with the requirements of the Contract Documents.

C. Reports: The agency shall send copies of test and inspection reports to the following parties:

1. 1 copy to the City/Owner or his representative
2. 3 copies to City / A/E Professional and/or Owners Representative
3. 1 copy to the Supplier of the material tested

D. Limitation of Authority: The Testing Agency is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the Work or to perform any construction work.

1.5 PAYMENT OF TESTING AGENCY

A. The Construction Manager shall pay for the Testing Agency services for testing of materials for compliance with the requirements of the Contract Documents. The Construction Manager shall also pay for testing and re-testing of materials that do not comply with the requirements of the Contract. Documents and all other items as specified in these Specifications.

PART 2- PRODUCTS (NOT APPLICABLE)
PART 3- EXECUTION

3.1 SCOPE OF WORK

A. This Section specifies materials testing for earthwork, reinforcing steel, concrete, and steel. These tests must be provided by Construction Manager 's independent Testing Agency and be paid for by Construction Manager.

3.2 EARTHWORK

A. Quality Control Testing Required During Construction

1. Inspection of Subgrade and Fill: The Testing Agency shall inspect and approve the following subgrades and fill layers before further construction work is performed thereon:

   a. Building slab subgrade, Paved areas subgrade, and/or Foundation wall backfill: As recommended by the Geotechnical Report enclosed within the Specifications.

2. Field Density Tests: Field density tests shall be performed according to ASTM D1556 "Density of Soil in Place by the Sand Core Method," ASTM D2167 "Density of Soil in Place by the Rubber Balloon Method" or ASTM 02922 "Density of Soil and Soil Aggregate in Place by Nuclear Methods" as applicable.

3. Acceptance Criteria: The results of field density tests by the Testing Agency will be considered satisfactory if the average of any three consecutive tests has a value not greater than 2 percent below the required density.

4. Report copies: The Construction Manager shall submit all results of field density tests certified by
Testing Agency to the Project Manager and Professional.

5. Additional testing: If reports by the Testing Agency indicate field densities lower than specified above, additional tests will be run by the Testing Agency with at least the frequencies scheduled above on recompacted fill and/or natural subgrade. The costs of such test shall be borne by the Construction Manager.

B. Inspection by the Testing Agency: The Construction Manager shall provide a Testing Agency to perform inspection service for the following listed items prior to pouring and placing foundation· concrete:

1. Spread (Dug) Footing Subgrade: Such inspection shall verify that field conditions are consistent with soil report test results and that the foundation is being installed in the

proper soil strata at the proper elevation. The Testing Agency's written field inspection reports shall be submitted by Construction Manager to Professional and Project Manager.

3.3 REINFORCING STEEL-

A. Visual Inspection: The Testing Agency shall inspect the reinforcing steel to determine the following:

1. The bars should be free from injurious defects and shall have a workman-like finish.
2. Deformations shall be of the proper sizes, shapes, and spacing as detailed in ASTM A-615.
3. The bars shall not have excessive rust and/or pelting.
4. The bars shall not have any unusual twists or bends

3.4 CONCRETE MATERIALS AND POURED IN PLACE CONCRETE

A. Concrete Mix Designs

1. The Construction Manager shall submit for approval concrete mix designs for each class of concrete indicated on the drawings and in the Specifications. The Construction Manager shall not begin work
until the applicable mix design has been approved.

2. Required types of concrete and compressive strengths shall be indicated on the Drawings and Specifications.

3. Admixtures

a. Quantities of admixtures to be used shall be in strict accordance with the manufacturer's instructions.

b. Admixtures containing chloride ions shall not be used in pre-stressed concrete, in concrete containing galvanized or aluminum embedments, or in metal deck floors or roofs.

B. Concrete Test Cylinders by Testing Agency

1. Molding and Testing: Cylinders for strength tests shall be molded and Laboratory cured in accordance with ASTM C31 "Method of Making and Curing Concrete Test Cylinders in the Field" and tested in accordance with ASTM C39 "Method of Testing for Compressive Strength of Cylindrical Concrete Specimens."

2. Field Samples: Field sample for strength tests -shall be taken in accordance with ASTM C172 "Method of Sampling Fresh Concrete."

a. Slump - ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

b. Air Content - ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day’s pour of each type of air-entrained concrete cured in accordance with ASTM C31 "Method of Making and Curing Concrete Test Cylinders in the Field" and tested in accordance with ASTM C39 "Method of Testing for Compressive Strength of Cylindrical Concrete Specimens."

2. Field Samples: Field sample for strength tests -shall be taken in accordance with ASTM C172 "Method of Sampling Fresh Concrete." Comply with the following ASTM sections.

    a. Slump - ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
    b. Air Content - ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
    c. Concrete Temperature- Test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and each time a set of compression test specimens is made.
    d. Compression Test Specimen- ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.

3. Compressive Strength Tests- ASTM C 39; one set for each day's pour exceeding 5 cu. yds. plus additional sets for each 50 cu. yds. more than the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

4. When frequency of testing will provide fewer than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

5. When total quantity of a given class of concrete is less than 50 cu. yds. Engineer may waive strength test if adequate evidence of satisfactory strength is provided.

6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

7. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

8. Test results will be reported in writing to Architect, Structural Engineer, Ready-Mix Producer, and Construction Manager within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

9. Nondestructive Testing -Impact hammer, Sono scope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

10. Additional Tests- The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been

attained in the structure, as directed by Architect/Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with

11. ASTM C 42, or by other methods as directed. Construction Manager shall pay for such tests when unacceptable concrete is verified.

12. Transporting cylinders: The Testing Agency shall be responsible for transporting the cylinders to the laboratory in a. protected environment such that no damage or ill effect will occur to the concrete cylinders.

D. Investigation of Low Strength Concrete Test Results

1. Field tests: The Testing Agency shall perform nondestructive field tests of the concrete in question using appropriate methods and report the results in the same manner as for cylinder test reports.

2. Strengthening of the structure or demolition: if the structural adequacy of the affected portion of the structure remains in doubt, the Construction Manager strengthen the structure by appropriate means approved by the Professional or demolish and rebuild the structure.

3. Cost of investigations for low strength concrete: the costs of all investigations of low strength concrete shall be borne by the Construction Manager.

E. Job site inspection: Verify that all concrete being placed meets job specifications. Report concrete not meeting the specified requirements and immediately notify the City.

F. Causes for rejection of concrete: The Construction Manager shall reject all concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect mix design number).
2. Concrete with temperatures exceeding 95°F may not be placed in the structure.
3. Slumps outside the limits specified in. the mix designs.
4. Excessive age. Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes, unless approved by the laboratory job inspector or other duly appointed representative.

G. Concrete Batch Trip Tickets: All concrete batch trip tickets shall qe collected and retained by the Construction Manager. All tickets shall contain the information specified in ASTM C94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exce.ed the specified water cement ratio for the design mix.

3.5 MASONRY

A. Mortar Tests

1. Mortar cube tests shall be required for loadbearing masonry construction only for the purpose of measuring uniformity of field batching.

2. Compressive Strength Test: Test shall be run according to the requirements of ASTM C780 “Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.”

B. Grout Tests

1. Grout prism tests shall be required for all grout used in masonry construction.

2. Compressive Strength Test: Specimens shall be 3 1/2" x 3 1/2" x 7" or 3" x 3" x 6" cast in molds with a flat nonabsorbent base and masonry units having the same moisture condition as those being laid forming the sides of the specimens. Specimens shall be capped according to ASTM C617 and tested according to ASTMC39.

3. Frequency of testing: Four grout prisms shall be made for each 30 cubic yards of grout but not less than one set for each day's operation. An additional set should be made whenever the grout mix is changed.

END OF SECTION

SECTION 012000 – PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

1.02 SCHEDULE OF VALUES

A. Submit itemized applications typed on City of Delray Beach Form No. G720 Payment Certificate Construction Services and AlA Document G702, Application and Certificate for Payment, and continuation sheet G702A or equivalent and shall include Port Project No., Advantage No., Vendor No. and P.O. No.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to A/E Professional and/or Owners Representative for approval.

C. Forms filled out by hand will not be accepted.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

A. Submit Applications for Payment to City of Delray Beach in accordance with the schedule established by Conditions of the Contract and Agreement between City of Delray Beach and Construction Manager.

B. Payment Period: Submit at intervals stipulated in the Agreement.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to A/E Professional and/or Owners Representative for approval.

D. Forms filled out by hand will not be accepted.

E. For each item, provide a column for listing each of the following:
   1. Item Number. Round off values to nearest dollar, or as specified for Schedule of Values.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders and CPEAMS.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

F. Execute certification by signature of authorized officer.

G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

H. List each authorized Change Order and CPEAM as a separate line item, listing Change Order and CPEAM number and dollar amount as for an original item of work.

I. Submit one electronic and three hard-copies of each Application for Payment.

1.04 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Construction Manager 's employ or subcontractors of changes to the Contract Documents.

B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, A/E Professional and / or Owners Representative will issue instructions directly to Construction Manager.

C. For other required changes, A/E Professional and/or Owners Representative will issue a document signed by City of Delray Beach instructing Construction Manager to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

D. For changes for which advance pricing is desired, A/E Professional and/or Owners Representative will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Construction Manager shall prepare and submit a fixed price quotation within 10 days.

E. Construction Manager may propose a change by submitting a request for change to A/E Professional and/or Owners Representative, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 60 00.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.

G. Substantiation of Costs: Provide full information required for evaluation.
   1. On request, provide the following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:
      a. Origin and date of claim.
      b. Dates and times work was performed, and by whom.
      c. Time records and wage rates paid.
      d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
   3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

H. Execution of Change Orders and CPEAMS: Construction Manager will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

I. After execution of Change Order and CPEAMS, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order and CPEAMS as a separate line item and adjust the Contract Sum.

J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

K. Promptly enter changes in Project Record Documents.

1.05 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1. Construction Documents
2. Coordination Drawings.
3. Administrative and supervisory personnel.
4. Project meetings.
5. BID Phase Requests for Interpretation (RFIs).
6. Construction Phase Requests for Interpretation (RFIs).

B. Related Sections include the following:

1. Division 1 Section "Construction Progress Documentation" for preparing and submitting Construction Manager's Project Schedule.
2. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 1 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Construction Manager seeking interpretation or clarification of the Construction Documents.

1.4 COORDINATION

A. Coordination: Construction Manager to 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 with other Construction Managers or subcontractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

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

1. Prepare similar memoranda for City and separate Construction Manager if coordination of their Work is required.

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

1. Preparation of Construction Manager 's Project Schedule.
2. Preparation of the Schedule of Values.
3. Preparation of the schedule of shop drawings / Sub-contractor submittals.
4. Submittal and Approval of all permits and Sub-contractor permits.
5. Installation and removal of temporary facilities and controls.
6. Delivery and processing of submittals.
7. Preconstruction meeting.
8. Construction document review meetings.
9. Progress meetings.
10. Preinstallation conferences.
11. Project closeout activities.
12. Startup and adjustment of systems.
13. Project closeout activities.
14. Preparation of schedule for mark-ups and Subs involved.

1.5 SUBMITTALS

A. Construction Documents: Provided by A/E Professional and/or Owners Representative

B. Key Personnel Names: Within **30** days of issuance of contract, submit a list of key personnel assignments, including superintendent, project manager, and other personnel responsible for the project. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, cellular, and office telephone numbers. Provide resumes, list of project completed with similar scope in the last three years, and references with contact information for each individual.

1. City Representative and A/E Professional and/or Owners Representative will review all supervisory personnel qualifications. Any individual not acceptable shall be replaced with someone satisfactory to the City and A/E Professional and/or Owners Representative.

a. The A/E Professional and/or Owners Representative or City may require replacement of supervisory individuals for poor performance and management, quality control problems, project delays, lack of oversight, etc. The Construction Manager shall comply with such request within 5 working days.

b. Construction Manager shall provide independently certified background checks, is required, to comply with state and local regulations. Any individual who does not pass the mandated requirements shall be removed immediately and replace with someone with a clean background.

2. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

3. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project Superintendent, provide a dedicated Project Manager specific to this project as a supervisor to oversee proper performance of the Work. Project Manager shall attend all meetings and have the authority to make decisions on behalf of the Construction Manager. Project Manager shall attend the site at a minimum once a day to evaluate the construction and to prepare a daily job report. Project Manager shall be responsible for all coordination, document handling, submittals review and processing, quality control, and project scheduling. The Project Manager, once approved, shall not be replaced without prior consent of the City and A/E Professional and/or Owners Representative.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings bi-weekly 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 City and A/E Professional and/or Owners Representative of scheduled meeting dates and times.

2. Construction Manager responsible to prepare meeting agenda & distribute meeting minutes for records. Also any necessary corrections after team reviews.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to City and A/E Professional and/or Owners Representative, but no later than 10 days after receiving all permits or City approval to proceed. All meetings on site at office trailer. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of City, A/E Professional and/or Owners Representative, and their consultants; Construction Manager, its consultants, and its superintendent; project manager; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative project schedule.

b. Critical work sequencing and long-lead items.

c. Procedures for processing field decisions and Change Orders.

d. Procedures for testing and inspecting.

e. Submittal procedures.

f. Preparation of Record Documents as billed by G.C.

g. Responsibility for temporary facilities and controls.

h. Construction waste management and recycling.

i. Office, work, and storage areas.

j. Equipment deliveries and priorities.

k. First aid.

l. Security.

m. Progress cleaning.

n. Working hours.

o. Mark up schedule.

p. Staging plan

q. Preliminary M.O.T.

r. Revit model review by G.C. and meeting schedules.

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 City and A/E Professional and/or Owners Representative 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. The coordination of Construction Documents.

b. Related RFIs and RFI log.

c. Related Change Orders.

d. Submittals. Submittal schedule for required items, per trade.

e. Review of mockups.

f. Possible conflicts.

g. Time schedules.

h. Weather limitations.

i. Manufacturer's written recommendations.

j. Warranty requirements.

k. Acceptability of substrates.

l. Temporary facilities and controls.

m. Regulations of authorities having jurisdiction.

n. Testing and inspecting requirements.

o. Installation procedures.

p. Coordination with other work.

q. Required performance results.

r. Protection of adjacent work.

s. Protection of construction and personnel.

t. Revit model and status update.

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 parties who should have been present.

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. Progress Meetings: Construction Manager conduct progress meetings at bi-weekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of City and A/E Professional and/or Owners Representative, Construction Manager, its consultants, and its superintendent; project manager; major subcontractors; suppliers; and other concerned parties shall attend the conference concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. 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. Construction Manager's Project Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Construction Manager 's Project 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.

2) Construction Manager to advise on any possible delays.

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

1) Interface requirements.

2) Sequence of operations.

3) Status of submittals and updated schedule.

4) Deliveries.

5) Off-site fabrication.

6) Access.

7) Site utilization.

8) Temporary facilities and controls.

9) Hazards and risks.

10) Progress cleaning.

11) Quality and work standards.

12) Status of correction of deficient items and schedule.

13) Field observations.

14) RFIs.

15) Pending changes.

16) Status of Change Orders.

17) Documentation of information for payment requests.

18) Fundamental commissioning of schedule.

19) Mechanical fundamental code required commissioning.

3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

a. Schedule Updating: Revise Construction Manager's Project 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.

1.8 CONSTRUCTION PHASE REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Construction Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall be submitted to the A/E Professional and/or Owners Representative for clarification with simultaneous copies to the City.

2. RFIs shall originate with Construction Manager. RFIs submitted by entities other than Construction Manager will be returned with no response.

3. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Construction Manager's work or work of subcontractors.

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

1. Project name.

2. Date.

3. Name of Construction Manager.

4. Name of Construction Manager’s Consultants.

5. RFI number, numbered sequentially.

6. Specification Section number and title and related paragraphs, as appropriate.

7. Drawing number and detail references, as appropriate.

8. Field dimensions and conditions, as appropriate.

9. Construction Manager's suggested solution(s).

10. Construction Manager's signature.

11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

a. Supplementary drawings prepared by Construction Manager shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Hard-Copy RFIs: CSI Form 13.2A.

1. Identify each page of attachments with the RFI number and sequential page number.

D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.

1. RFIs shall be electronic files in Microsoft Word Document Format.

2. Attachments shall be electronic files in Adobe Acrobat PDF format.

a. Construction Manager's Consultants' Action: Construction Manager's Consultants or Sub Contractor will review each RFI, determine action required, and return it. Construction Manager's Consultants will have **5** working days for response for each RFI.

E. On receipt of Construction Manager's Consultants' or Sub-contractor's action, update the RFI log and immediately distribute the RFI response to affected parties.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly. Use CSI Log Form 13.2B. Include the following:

1. Project name.
2. Name and address of Construction Manager.
3. Name and address of A/E Professional and/or Owners Representative.
4. Name of Construction Manager's Consultants.
5. RFI number including RFIs that were dropped and not submitted.
6. RFI description.
7. Date the RFI was submitted.
8. Date Construction Manager Consultants' response was received.
9. Date City or A/E Professional and/or Owners Representative response was received, if required. Allow minimum 10 working days for A/E Professional and/or Owners Representative previews.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction Schedule

B. Contract Progress Reporting

C. Construction Photographs

D. Construction Aerial Photographs

1.02 RELATED SECTIONS

A. Section 01 01 00 - Summary of Work: Work sequence, City Occupancy.

B. Section 01 20 00 - Payment Procedures: Application for payment and schedule of values.

C. Section 01 31 00 - Project Management and Coordination: Progress Meetings

D. Section 01 33 00 - Submittal Procedures: Shop drawings, product data, samples and other submittals.

1.03 INITIAL CONSTRUCTION SCHEDULE

A. Format

1. Prepare initial schedule as a horizontal bar chart with separate bar for each major portion of Work or operation, identifying first work day of each week and subsequent major milestones as specified below.

2. Sequence of Listings: The chronological order of the start of each item of Work.

3. Scale and Spacing: To provide space for notations and revisions.

4. Sheet Size: Multiples of 8-1/2 inches x 11 inches.

B. Content

1. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

2. Dates of Substantial Completion for the Work or its defined stages: Conform to the dates established in the Contract Documents.

3. Identify each item by the appropriate assembly designation as established by the Contract Documents and as outlined in the “CSI/CSC Uniformat Uniform classification of Construction Systems and Assemblies”, latest edition as published by the Construction Specifications Institute.

4. Identify work of separate stages, phases, buildings, floor levels and other logically grouped activities and major project milestones based on the schedule of values (Proposal Worksheet Detail and Proposal Worksheet Summary) as minimum level of detail

5. Provide sub-schedules for each stage of Work identified in Section 01 01 00, Summary of Work, or elsewhere in the Contract Documents.

6. Provide sub-schedules to define critical portions of the entire schedule.

7. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

8. Provide separate schedule of submittal dates for shop drawings, product data, and samples, including any City furnished products, and dates reviewed submittals will be required from Project Consultant. As applicable, indicate decision dates for selection of finishes. Refer to related requirements in Section 01 33 00, Submittal Procedures.

9. Indicate projected delivery dates for City furnished products or direct purchased items.

C. Schedule Submittals

1. Submit initial schedules as Post Award Information. After review, resubmit required revised data within ten days.

2. Submit revised Progress Schedules as specified below with each three (3) Application for Payment.

3. Submit three (3) full size opaque reproductions and three (3) electronic media copies (USB flash drives) which Construction Manager requires, which will be retained by the Project Consultant and City.

D. Distribution of Schedule:

1. Distribute copies of reviewed schedules to Project site file, Subcontractors, suppliers, and other concerned parties.

2. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

1.04 CONSTRUCTION SCHEDULES

A. Quality Assurance:

1. Scheduler: Provide a scheduling specialist (from either the Construction Manager's own staff or as a consultant to the Construction Manager) specializing in CPM with experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed printout within 72 hours of request.

B. Format

1. Listings: Reading from left to right, in ascending order for each activity. Identify each activity with the applicable identification number.

2. Diagram Sheet Size: required height x width required.

3. Scale and Spacing: To allow for notations and revisions.

C. Schedules

1. Prepare network analysis diagrams and supporting mathematical analyses based upon information provided by Construction Manager using “Primavera Project Planner" by Primavera Systems, Inc.

2. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

3. Illustrate complete sequence of construction by activity, identifying work within each major building area, wing, site area, project phase or other uniform breakdown of the Work.

    a. Provide dates for submittals and return of submittals; dates for procurement and delivery of critical products; and dates for installation and provisions for testing.

    b. Provide legend for symbols and abbreviations used.

    c. Allow no single activity to exceed, in days, ten percent of the total project duration.

4. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identifying for each activity:

    a. Activity identification number.
    b. Preceding and following event numbers.
    c. Activity description.
    d. Estimated duration of activity.
    e. Earliest start date.
    f. Earliest finish date.
    g. Actual start date.
    h. Actual finish date.
    i. Latest start date.
    j. Latest finish date.
    k. Total and Free Float: Float time shall accrue to City and to City's benefit.
    l. Percentage of activity completed.
    m. Responsibility.

5. Analysis Program: Capable of accepting revised completion dates and re-computation of all dates and float.

6. Required Sorts: List activities in sorts or groups:

    a. By work item or event number from lowest to highest.
    b. By amount of float, then in order of early start.
    c. By responsibility in order of earliest possible start date.
    d. In order of latest allowable start dates.
    e. In order of latest allowable finish dates.
    f. Listing of basic input data which generates the report.
    g. Listing of activities on the critical path.

h. Coordinate contents with the Schedule of Values (Proposal Worksheet Detail and Proposal Worksheet Summary).

D. Submittals:

1. Submit first Construction Schedule for review after the approval of the Initial Schedule specified above and not later than five (5) days prior to the Construction Manager's first application for payment.

a. Schedule: Comprised of a complete network analysis consisting of network diagrams and mathematical analysis.

b. Include written certification that mechanical, electrical and other major Subcontractors have reviewed and accepted proposed schedule.

2. Submit updated network schedule with each Application for Payment accurately depicting progress to date of application; and whenever major schedule elements fall two (2) weeks behind original schedule. Monthly schedule submittals shall include:

a. Monthly Bar Chart Update:

1. A bar chart comparing current progress to the most recently approved target schedule.

2. Sort the chart by area, Early Start Date, and show the activity identification description, Remaining Duration Total Float, and percentage complete.

3. Submit on 8-1/2 inch by 11 inch paper.

b. Task Summary Report: A summary bar chart showing current and target schedule. A tabular portion of the bar chart shall show the early start dates, early finish dates, remaining duration and percentage complete.

c. Tabular Reports:

1. Schedule Report: List the current status of all activities, sorted by activity number from lowest to highest by area, phase or other breakdown.

2. Total Float Report: List all uncompleted activities sorted by total float, then by early start date.

3. Submit complete schedule and updates on three (3) USB flash drives accompanied by three (3) opaque reproductions.

a. Comply with electronic media requirements specified for Section 01 78 00, Closeout Submittals.

b. Ensure submittal of complete information and media.

4. Submit under provisions specified in Section 01 33 00, Submittal Procedures.

E. Review and Evaluation:

1. Project Consultant and City will review network diagrams and analysis and provide comments thereon.

2. Participate in joint review and evaluation of network diagrams and analysis with Project Consultant at each submittal if requested by Project Consultant.

3. Evaluate project status to determine work behind schedule and work ahead of schedule.

4. After review, revise as necessary as result of review, and resubmit within five (5) days.

F. Updating Schedules:

1. Maintain schedules to record actual start and finish dates of completed activities.

2. Indicate progress of each activity to date of revision, with projected completion date of each activity. Update diagrams to graphically depict current status of Work.

3. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

4. Indicate changes required to maintain Dates of Substantial and Final Completion

5. Submit sorts required to support recommended changes.

6. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken (or proposed) and its effect on the Work.

G. Distribution of Schedule:

1. Distribute copies of reviewed schedules to project site file, Subcontractors, suppliers, and other concerned parties.

2. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

3. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken (or proposed) and its effect on the Work, including the effect of changes on schedules of separate Construction Manager or the City's forces.

1.05 CONSTRUCTION PROGRESS REPORTING

A. Construction Manager's Daily Log

1. Maintain a daily log of project activity including, but not limited to:

a. Hours on the project site.
b. Weather conditions (including a summary of changing conditions through the day).
c. Daily construction activity.
d. Number of workers in each trade on site (and the duration of their stay).
e. Number of journeymen and certified journeymen on site for each trade.
f. General observations.
g. Written and verbal directives to the Construction Manager.
h. Visits of Building Department Officials, or City staff.

i. Visits by the Project Consultant or his Sub-consultants.
j. Visits by the City.
k. Inspections by jurisdictional authority for work in right-of-ways or outside the City's property line.

2. Make log immediately available on site to the Project Consultant, City and other jurisdictional authorities.

B. Construction Manager's Weekly Progress Report

1. Summarize Daily Log on: Weekly Progress Report. Include reports from subcontractors.

2. Weekly Report Submittals:

a. Deliver three (3) copies of Weekly Progress Report to the Project Consultant at the end of each week.

b. Attach a copy of the Construction Manager's daily log to each copy of Weekly Progress Report submitted.

3. Submit under provisions of Section 01 33 00 – Submittal Procedures.

4. Submit copies of Weekly Progress Reports for the respective payment period with copies of Construction Manager's Daily Log not yet submitted under provisions of Section 01 20 00, Payment Procedures.

C. Special Reports:

1. Reporting Unusual Events: When an event of an unusual and significant nature occurs at the site, prepare and submit a special report.

a. List chain of events, persons participating, response by the Construction Manager's personnel, an evaluation of the results or effects and similar pertinent information.

b. Advise the City and Project Consultant in advance when such events are known or predictable.

2. Submit special reports to the Project Consultant and the City within one day of an occurrence. Submit copies of the report to other entities that are affected by the occurrence.

3. Reporting Accidents: Prepare and submit reports of significant accidents on the project site or anywhere else the Work is in progress.

a. Record and document data and actions. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

1.06 CONSULTANT'S OBSERVATIONS

A. The Consultant will make bi-weekly visits to the Work and make observations of the progress of the Work as required elsewhere in the Contract Documents:

B. The Consultant (and Sub-consultants through the Consultant) will:

1. Prepare and distribute Periodic Observation Report to the Construction Manager, City and other concerned parties after each visit to the Site.

2. Prepare and distribute Non-Conforming Work Notice, to the Construction Manager, City and other concerned parties when deficient or otherwise non-conforming Work is discovered during visits to the Work.

3. Take appropriate follow-up actions as required by the Contract Documents to facilitate the continuing progress of the Work and its conformance to the requirements of the Contract Documents.

1.07 CONSTRUCTION PHOTOGRAPHS

A. Provide photographs of site and construction throughout progress of Work.

B. Employ professional commercial photographer acceptable to the Project Consultant, to take construction record photographs periodically during the course of work. Photographer shall be a firm or individual of established reputation who has been regularly engaged as a professional photographer. Provide two references for which the photographer has performed work of similar nature.

C. Release of Photographs: Photographs shall not be released to parties other than the City and Project Consultant without the City's permission as per Section 119.071 (3)(b), Florida Statutes.

D. Take photographs 3 days prior to each application for a payment, and as follows:

1. Existing site and facility (both interior and exterior) conditions prior to the start of the Construction Manager’s activities.

2. With each pay application.

3. Substantial Completion.

4. Final completion.

5. As necessary to supplement Construction Manager’s Daily or Monthly Reports.

6. As necessary to document Change Proposals and/or facilitate other communications regarding the Work.

E. Quantities Required:

1. Photograph the Work from different views to show degree of completion of progress as well as unusual or special construction procedures. Submit a minimum of thirty-six (36) photographs showing different views, three (3) copies of each view, for each application for payment.

F. Prints:

1. Full color.

2. Paper Surface (Color): Smooth, glossy.

3. Contrast (Color): High.

4. Size: 8 X 10 inch (35 mm); mounted for binder and tabs.

5. Identify each print on reverse side. Identify:

   a. Project Name.
   b. Project number
   c. Applicable phase
   d. Orientation of view
   e. Date and time of view
   f. Name and address of photographer
   g. Photographer's numbered identification of exposure.

G. Digital Media:

1. The photographer shall retain the original digital media for a minimum of ten (10) years after the date of substantial completion. After the ten (10) year period, if the photographer (or its successors or assigns) has any intention of disposing of the digital media, he/she shall first notify the City or the Project Consultant. The City may elect to assume responsibility for storage and accessibility of the digital media. If the City does not want to assume this responsibility, he/she may designate an alternate such as the Project Consultant to accomplish the task of insuring protection, storage and availability of the digital media. In this situation, the photographer will present the digital media along with proper storage medium and table of contents to the appropriate authority.

H. Technique

1. Provide factual presentation.

2. Provide correct exposure and focus, high resolution and sharpness, maximum depth-of-field and minimum distortion.

I. Photography Submittals

1. Deliver prints and electronic media in the form of USB flash drives with each Application for Payment with transmittal letter specified under Section 01 33 00 – Submittal Procedures.

2. Deliver prints not required for an Application for Payment three (3) days after exposure with transmittal letter specified under Section 01 33 00 – Submittal Procedures.

1.08 CONSTRUCTION AERIAL PHOTOGRAPHS

A. Provide aerial photographs of the site taken on or about the cutoff date for each scheduled Application for Payment or as otherwise required by the City.

B. Employ professional commercial aerial photographer acceptable to the Project Consultant, to take construction record photographs periodically during the course of work. Photographer shall be a firm or individual of established reputation who has been regularly engaged as a professional aerial photographer. Provide two references for which the aerial photographer has performed work of similar nature.

C. Release of Photographs: Photographs shall not be released to parties other than the City and Project Consultant without the City's permission.

D. Provide aerial photograph with each monthly application for payment and as follows:

1. Existing site prior to the start of Construction Manager operations.

2. With each application for payment

3. Landscaping

4. Substantial and Final Completion of a major phase or component of work.

E. Digital Media:

1. The aerial photographer shall retain the original digital media for a minimum of five (5) years after the date of substantial completion. After the five (5) year period, if the aerial photographer (or his or hers, successors or assigns) has any intention of disposing of the digital media, he or she shall first notify the City or the Project Consultant. The City may elect to assume responsibility for storage and accessibility of the digital media. If the City does not want to assume this responsibility he may designate an alternate such as the Project Consultant to accomplish the task of insuring protection, storage and availability of the digital media. In this situation, the photographer will present the digital media along with proper storage medium and table of contents to the appropriate authority.

2. Digital media resolution and grain requirements:

a. Resolution: 1.6:1 - 50 lines per mm
1000:1- 100 lines per mm

b. Grain: Diffuse RMS Granularity Value Of 5

F. Costs of aerial photographer:

1. Construction Manager shall pay costs for specified photography and prints.

2. Parties requiring additional photography or prints authorized by the City will pay photographer directly.

3. Additional Photo Missions/Views/Prints: From time to time the City or Project Consultant may issue requests for additional photo missions/views/prints, in addition to periodic photo missions/views/prints specified. Additional requirements will be paid to the Photographer directly by the City or Project Consultant.

a. The Project Consultant will give the photographer 3 working days' notice where feasible.

b. In emergency situations, the photographer shall take additional photographs within 24 hours of the Project Consultant's request.

4. Additional Prints, when requested by the Project Consultant and approved by the City, shall be provided at prevailing local commercial prices to designated parties. The designated parties, in each case, shall pay the photographer directly for such prints.

G. Prints and Electronic Media (USB flash drives)

1. Provide three (3) full color prints and electronic media (USB flash drives) of each of four (4) views.

2. Paper: Single Weight, Commercial Grade. Finish shall be: Glossy.

3. Size: 8" x 10" mounted in 8 1/2" x 11", top loading, heavy-duty Mylar sheet protectors.
4. Identify each print on reverse listing:

   a. Name of Project
   b. Project Number.
   c. Orientation of view
   d. Date and Time of Exposure
   e. Name and Phone Number of Photographer
   f. Photographer's numbered identification of exposure.
   g. Construction Manager's Name

H. Technique:

1. Provide factual presentation

2. Photographs shall be taken during good weather conditions with adequate lighting. Photographs with cloud shadows on the primary target shall not be acceptable.

3. Provide correct exposure of film using shutter speed appropriate to the task of stopping action and lens aperture setting to eliminate soft focus at the edges of negatives. Maximum depth of field and critical focus is required to produce images with high resolution and contrast to show maximum detail with minimum grain. A lens corresponding to the film format which will control optical distortion shall be used.

4. Aerial Views and Quantities Required:

   a. Photograph the work from a minimum of three (4) different directions (views) as approved by the Project Consultant with vantage points to best show the entire site, detailed close-up images of the Work, and status of construction progress since taking the previous photographs. Unless requested otherwise, take all monthly photographs from the same direction and altitude.

   b. The altitude and angle of view selected by the aerial photographer will be such that the image captured will include and emphasize the entire site while eliminating, as much as possible, excessive amounts of foreground, background and especially horizon and sky.

I. Photography Submittals:

1. Deliver three (3) prints of each view with each Application for Payment with transmittal letter specified under Section 01 33 00 – Submittal Procedures.

2. Deliver prints not required for an Application for Payment three (3) days after exposure with transmittal letter specified under Section 01 33 00 – Submittal Procedures.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION NOT USED

END OF SECTION

SECTION 013216 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, with network analysis diagrams and reports.

1.02 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM.

1.03 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major Construction Manager have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit the number of opaque reproductions that Construction Manager requires, plus two copies that will be retained by A/E Professional and/or Owners Representative.

1.04 QUALITY ASSURANCE

A. Scheduler: Construction Manager's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.05 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules to define critical portions of the entire schedule.

E. Include conferences and meetings in schedule.

F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

G. Provide separate schedule of submittal dates for shop drawings, product data, and samples, City-furnished products, products identified under Allowances, and dates reviewed submittals will be required from A/E Professional and/or Owners Representative. Indicate decision dates for selection of finishes.

H. Provide legend for symbols and abbreviations used.

3.03 NETWORK ANALYSIS

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to City of Delray Beach and to City of Delray Beach 's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.
   3. By responsibility in order of earliest possible start date.
   4. In order of latest allowable start dates.
   5. In order of latest allowable finish dates.
   6. Construction Manager's periodic payment request sorted by Schedule of Values listings.

3.04 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with A/E Professional and/or Owners Representative at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Construction Manager's project site file, to subcontractors, suppliers, A/E Professional and/or Owners Representative, City of Delray Beach, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

C. Provide electronic version in the scheduling software on a monthly basis and when requested. Up load to Procore.

END OF SECTION

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS competitive bid

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:

1. Division 1 Section 012000 "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.

2. Division 1 Section 013100 "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.

3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including General Construction Manager's Construction Schedule and the Submittals Schedule.

4. Division 1 Section 014000 "Quality Requirements" for submitting test and inspection reports and for mockup requirements.

5. Division 1 Section 017800 "Closeout Submittals" for submitting warranties.

6. Division 1 Section 017810 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

7. Division 1 Section 017820 "Operation and Maintenance Data" for submitting operation and maintenance manuals.

8. Division 01 Section 018113 "Sustainable Design Requirements" for additional FGBC submittal requirements.

9. Division 1 Section 018200 "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of City's personnel.

10. Divisions 2 through 48 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires A/E Professional and/or Owners Representative responsive action.

B. Informational Submittals: Written information that does not require A/E Professional and/or Owners Representative responsive action. Submittals may be rejected for not complying with requirements.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. 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. A/E Professional and/or Owners Representative reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

E. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on A/E Professional and/or Owners Representative 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 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. A/E Professional and/or Owners Representative will advise Construction Manager 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 working days for review of each resubmittal.

4. Sequential Review: Where sequential review of submittals by A/E Professional and/or Owners Representative consultants, City, or other parties is indicated, allow 21 working days for initial review of each submittal.

F. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.

2. Provide a space approximately 6 by 8 inches on label or beside title block to record Construction Manager's review and approval markings and action taken by A/E Professional and/or Owners Representative.

3. Include the following information on label for processing and recording action taken:

    a. Project name.

    b. Date.

    c. Name and address of A/E Professional and/or Owners Representative.

    d. Name and address of Construction Manager.

    e. Name and address of subcontractor.

    f. Name and address of supplier.

    g. Name of manufacturer.

    h. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

    i. Number and title of appropriate Specification Section.

    j. Drawing number and detail references, as appropriate.

k. Location(s) where product is to be installed, as appropriate.

l. Other necessary identification.

G. Deviations: Highlight, encircle, and otherwise specifically identify deviations from the Contract Documents on submittals.

H. Additional Copies: Unless additional copies are required for final submittal, and unless A/E Professional and/or Owners Representative observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal concurrently to City's Representative reviewer in addition to specified number of copies to A/E Professional and/or Owners Representative.

2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. A/E Professional and/or Owners Representative will return submittals, without review, received from sources other than Construction Manager.

1. Transmittal Form: Provide locations on form for the following information:

a. Project name.

b. Date.

c. Destination (To:).

d. Source (From:).

e. Names of subcontractor, manufacturer, and supplier.

f. Category and type of submittal.

g. Submittal purpose and description.

h. Specification Section number and title.

i. Drawing number and detail references, as appropriate.

j. Transmittal number **(**numbered consecutively).

k. Submittal and transmittal distribution record.

l. Remarks.

m. Signature of transmitter.

2. On an attached separate sheet, prepared on Construction Manager's letterhead, record relevant information, requests for data, revisions other than those requested by A/E Professional and/or Owners Representative on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

3. Submit CONSTRUCTION MANAGER'S SHOP DRAWING SUBMITTAL CERTIFICATION at the end of this section with each submittal. Submittals without the certification will be returned without action. All submittals to be reviewed and approved by Construction Manager prior to submittal.

J. 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 "Reviewed" or "Reviewed as Noted".

K. 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.

L. Use for Construction: Use only final submittals with mark indicating "Reviewed" or "Reviewed as Noted" taken by A/E Professional and/or Owners Representative.

M. All shop drawings and samples are to be submitted in the following groups. All data is to be reviewed by Construction Manager. Submittal groups must be complete - Incomplete submittals will be rejected.

GROUP SUBMITTALS are as follows:

1. LIFE SAFETY

   Group 1: Dry Chemical Sprinkler system

   Group 2: Fire Alarm system and anunciators

2. HVAC

   All HVAC equipment, controls, ductwork, accessories, piping diagrams, etc. All submittals in 1 group.

3. Electric

   Group 1: Lighting Fixture package, switch gear, etc. All submittals in 1 group.

   Group 2: Site Lighting and calculations

   Group 3: Storage tank, pumps, control panels, accessories.

   Group 4: Surge and Lightning Protection

   Group 5: Fire Alarm System

4. Technology

   Group 1: Security System CCTV and Access Control Package.

   Group 2: Phone, Data, Communications, Digital Amplification System Package.

   Group 3: Audio / Visual Package.

   Group 4: Burglar Intrusion Alarm System

5. Plumbing

   Fixture package, piping, pumps, controls and accessories. Include all related pools equipment and controls. All submittals in 1 group.

6. Structural

   Group 1: Foundation rebar, soil compaction reports, concrete mix, concrete block, column rebar.

   Pools shop dwgs. and submittals.

   Group 2: Walls, Floors and Roof framing systems, miscellaneous steel,

   Group 3: Miscellaneous metals, exterior misc. framing, etc.

7. Architectural

Group 1: All interior finishes, etc.

Group 2: Exterior finishes, roofing, stucco, reglets, trims, reveals, veneers, etc.

Group 3: Casework and Counters

Group 4: Railings

Group 5: Site Amenities, fencing, etc.

Group 6: Elevators

Group 7: Restroom Accessories, Concession room, and ticket room equipment.

Group 8: Storefronts, doors, hardware, windows, etc.

Group 9: Misc. accessories and signage

8. Civil / Landscape

Group 1: Water, sewer, drainage – piping, fittings, structures, etc.

Group 2: Paving, detectable warning, signage, etc.

Group 3: Hardscape, site furnishings.

Group 4: Landscape and Irrigation

9. Sporting Equipment and Playground

All Playgrounds, Pool Features, Fitness Equipment and Sporting Equipment to include controls & applicable accessories.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

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 printed 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 written recommendations.

b. Manufacturer's product specifications.

c. Manufacturer's installation instructions.

d. Standard color charts.

e. Manufacturer's catalog cuts.

f. Wiring diagrams showing factory-installed wiring.

g. Printed performance curves.

h. Operational range diagrams.

i. Standard product operation and maintenance manuals.

j. Compliance with specified referenced standards.

k. Testing by recognized testing agency.

l. Notation of coordination requirements.

m. Warranty for product or equipment

4. Submit Product Data before or concurrent with Samples.

5. Number of Copies: Submit (4) four copies of Product Data in addition to electronic PDF document, unless otherwise indicated. A/E Professional and/or Owners Representative will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Document.

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 shop dwgs and Submittals. Include the following information, as applicable:

a. Dimensions.

b. Identification of products.

c. Fabrication and installation drawings.

d. Roughing-in and setting diagrams.

e. Schedules.

f. Design calculations.

g. Compliance with specified standards.

h. Notation of coordination requirements.

i. Notation of dimensions established by field measurement.

j. Relationship to adjoining construction clearly indicated.

k. Seal and signature of professional engineer if specified.

l. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.

3. Number of Copies: Submit (5) five opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit two additional copies where copies are required for operation and maintenance manuals. A/E Professional and/or Owners Representative will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.

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 appropriate Specification Section.

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 not incorporated into the Work, or otherwise designated as City's property, are the property of Construction Manager.

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 five (5) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. A/E Professional and/or Owners Representative 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 (8) eight sets of Samples. A/E Professional and/or Owners Representative 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. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.

2. Number and name of room or space.

3. Location within room or space.

4. Number of Copies: Submit six copies of product schedule or list, unless otherwise indicated. A/E Professional and/or Owners Representative will return two copies.

a. Mark up and retain one returned copy as a Project Record Document.

F. Submittals Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

G. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."

H. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

I. 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. Use CSI Form 1.5A. Include the following information in tabular form:

1. Name, address, and telephone number of entities 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.

4. Number of Copies: Submit (4) four copies of subcontractor list, unless otherwise indicated. A/E Professional and/or Owners Representative will return two copies.

a. Mark up and retain one returned copy as a Project Record Document.

J. FGBC Submittals: Florida Green Building Coalition (FGBC) min. silver rating.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit (4) four copies of each submittal, unless otherwise indicated. A/E Professional and/or Owners Representative will not return copies. This is in addition to required digital pdf submittal.

2. Certificates and Certifications: Provide a notarized 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. Installation, application, compliance certification is required for all floor anti slip coatings in pool deck by Construction Manager.
   b. Certification of compliance to be provided by Construction Manager.

3. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

C. Construction Manager's Project Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm, sub-contractor or person. Include lists of completed projects with project names and addresses, names and addresses of A/E Professional and/or Owners Representative and City, and other information specified.

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

F. Installer Certificates: Prepare 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.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

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

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

J. Material Test Reports: Prepare 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.

K. Product Test Reports: Prepare written reports indicating 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.

L. Research/Evaluation Reports: Prepare 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.

M. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

N. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.

O. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."

P. Design Data: Prepare 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 Construction Documents and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

Q. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturers. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.

5. Required adjustments.

6. Recommendations for cleaning and protection.

R. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service 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.

S. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

T. Construction Photographs: Comply with requirements specified in Division 1 Section " Photographic Documentation."

2.3 DELEGATED DESIGN

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

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to A/E Professional and/or Owners Representative.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit six copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Construction Manager to be designed or certified by a design professional.

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

PART 3 - EXECUTION

3.1 CONSTRUCTION MANAGER'S REVIEW

A. 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 A/E Professional and/or Owners Representative.

B. 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 Construction Manager's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract.

3.2 A/E PROFESSIONAL AND/OR OWNERS REPRESENTATIVE'S ACTION

A. General: A/E Professional and/or Owners Representative will not review submittals that do not bear Construction Manager's approval stamp and will return them without action.

B. Action Submittals: A/E Professional and/or Owners Representative will review each submittal, make marks to indicate corrections or modifications required, and return it. A/E Professional and/or Owners Representative will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. **Final Unrestricted Release:** Where the submittals are marked as follows, the work covered by the submittal may proceed provided it complies with the requirements of the Contract Documents; acceptance of the work will depend upon that compliance.

   Marking: "Reviewed"

2. **Final-But-Restricted Release:** When the submittals are marked as follows, the work covered by the submittal may proceed provided it complies with both the A/E Professional and/or Owners Representative notations or corrections on the submittal and with the requirements of the contract documents; acceptance of the work will depend on that compliance.

   Marking: "Reviewed as Noted".

3. **Returned for Re-Submittal:** When the submittal is marked as follows do not proceed with the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise the submittal or prepare a new submittal in accordance with the A/E Professional and/or Owners Representative notations stating the reasons for returning the submittal; re-submit the submittal without delay. Repeat if necessary, to obtain a different action marking. Do not permit submittals with the following marking to be used at the project site, or elsewhere where work is in progress.

   Marking: "Rejected"

   Marking: "Revise and Resubmit"

   Marking: "Submit Specified Item"

C. Informational Submittals: A/E Professional and/or Owners Representative will review each submittal and will not return it or will return it if it does not comply with requirements. A/E Professional and/or Owners Representative will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

F. Submit CONSTRUCTION MANAGER'S SHOP DRAWING SUBMITTAL CERTIFICATION at the end of this section with each submittal. Failure to submit required certification will result in rejection of the submittal. Additional time or compensation will not be given to the Construction Manager for delays caused by the Construction Manager not following the stated submittal requirements.

G. The first submittal for each required item will be reviewed free of charge. Each subsequent submittal review, for previously failed or incomplete submittals, will be billed on an hourly basis at $150 / hr. Construction Manager shall be responsible for payment of rejected submittals on a monthly basis. Non-payment will result in termination of review services.

END OF SECTION

Construction Manager'S SHOP DRAWING SUBMITTAL CERTIFICATION

Project Name:

City:

Construction Manager:

Date:

Submittal Title: Specification Section:

Submittal Group:

I, _____, as the Construction Manager's authorized representative of the said project, certify that the attached shop drawing submittal complies specification section 01 33 00, all other applicable specification sections, and the construction documents. I have reviewed the shop drawings submitted by the suppliers or sub-contractors and the following conditions have been satisfied:

Yes No N/A

☐ ☐ ☐ Have minimum required quantity of submittals attached. Number of submittals _____

☐ ☐ ☐ Have you reviewed the shop drawing submittal for conformance with the plans and specifications. All

dimensions been cross-checked with plans and field verified for actual dimensions.

☐ ☐ ☐ Have you marked all applicable options and accessories to be supplied or required.

☐ ☐ ☐ Have you coordinated with all other trades or associated items (i.e. elec. voltage, data, water supply, venting, etc.)

☐ ☐ ☐ Is the submitted product identical to the specified item in section _____

☐ ☐ ☐ If a substitution, has the substitution been approved during the bid phase.

☐ ☐ ☐ All deviations from the plans or specification have been clearly identified on each page.

☐ ☐ ☐ For all exterior components, are the Miami-Dade product approvals attached

☐ ☐ ☐ Have you reviewed the Miami-Dade product approval. (N.O.A.) or State product approval. Also confirm product rated HVZ.

☐ ☐ ☐ For sample specified, are material samples with specified finish and color attached

☐ ☐ ☐ If sign and sealed engineering is specified, are the engineering calculations attached.

☐ ☐ ☐ If manufacturer's product data is specified, is the information attached

☐ ☐ ☐ Have you reviewed and noted manufacturer's instructions and recommendations

☐ ☐ ☐ If a warranty is specified, is a sample warranty for the specified period attached.

☐ ☐ ☐ If installer's qualification certification specified, is the certification attached.

☐ ☐ ☐ If Producer's Statement of applicability required, is one attached.

If you answered 'NO' to any question listed above, do not forward the submittal to the A/E Professional and/or Owners Representative. It will not be reviewed. All reviews after the second review, will be billed directly to the Construction Manager. As noted in section 013300- article 3.2 G.

Signature _____ Title_____ Date_____

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This 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 Construction Manager of responsibility for compliance with the Construction 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 Construction Manager's other quality-assurance and -control procedures that facilitate compliance with the Construction Document requirements.

3. Requirements for Construction Manager to provide quality-assurance and -control services required by A/E Professional and/or Owners Representative, City, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:

1. Division 1 Section "Project Record Documents" for final testing reports, inspection records, and certifications.

2. Divisions 2 through 48 Sections for specific test and inspection requirements.

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 A/E Professional and/or Owners Representative.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged. (By G.C)

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. 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 industry standards.

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

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

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

J. Installer/Applicator/Erector: Construction Manager or another entity engaged by Construction Manager as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: 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 uncertainties and requirements that are different, but apparently equal, to A/E Professional and/or Owners Representative 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 A/E Professional and/or Owners Representative for a decision before proceeding.

1.5 SUBMITTALS

A. Qualification Data: 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.

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

1. Specification Section number and title.

2. Description of test and inspection.

3. Identification of applicable standards.

4. Identification of test and inspection methods.

5. Number of tests and inspections required.

6. Time schedule or time span for tests and inspections.

7. Entity responsible for performing tests and inspections.

8. Requirements for obtaining samples.

9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that 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 Construction Document requirements.

12. Name and signature of laboratory inspector.

13. Recommendations on retesting and reinspection.

D. Permits, Licenses, and Certificates: For City'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.

1.6 QUALITY ASSURANCE

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

B. Installer Qualifications: A firm, company 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.

C. 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.

D. 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.

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

F. Specialists: Certain sections of the Specifications 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. Requirement for specialists shall not supersede building codes and regulations governing the Work.

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 548; 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. 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.

1.7 QUALITY CONTROL TESTS AND SPECIAL INSPECTIONS

A. The following tests and inspections are A/E Professional and/or Owners Representative responsibility on behalf of the City. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required by authorities having jurisdiction, whether specified or not.

1. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.

2. Testing and inspecting requested by Construction Manager and not required by the Construction Document are Construction Manager's responsibility.

3. Submit copies of each written report directly to authorities having jurisdiction, when they so direct.

4. The following tests, inspections, and certifications shall be performed by independent testing agencies, special inspector, or professional engineers, hired by the A/E Professional and/or Owners Representative, City at the Construction Manager’s expense, to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of City, and as follows:

a. Soils compaction and density.

b. Concrete cylinder tests.

c. Structural engineered masonry.

d. Structural welding certification.

e. Inspections:

1) Piles / Drill Shaft.

2) Metal deck testing of welds.

3) Bolted and welded connections.

4) Concrete slump and strength testing.

5) Grout and mortar testing.

6) Windows installation and water infiltration testing.

7) Roofing.

8) Waterproofing.

B. The following tests and inspections are Construction Manager responsibility at the Construction Manager's expense:

1. The following tests, inspections, and certifications shall be performed by independent testing agencies, special inspector, or professional engineers, hired by the Construction Manager:

a. Water infiltration testing for storefront systems, windows, doors, service window and ticket booth window.

b. Bell chamber testing for the roofing membrane.

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 Division 1 Section "Submittal Procedures."

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

1. A/E Professional and/or Owners Representative or the City will not pay for retesting or reinspection fees.

E. Testing Agency Responsibilities: Cooperate with A/E Professional and/or Owners Representative and Construction Manager in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify A/E Professional and/or Owners Representative and Construction Manager 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 Construction Manager.

5. Do not release, revoke, alter, or increase the Construction Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Construction Manager.

F. 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. Preliminary design mix proposed for use for material mixes that require control by testing agency.

6. Security and protection for samples and for testing and inspecting equipment at Project site.

G. 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.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Construction Documents. Submit schedule within 30 days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to City, A/E Professional and/or Owners Representative, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. 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 A/E Professional and/or Owners Representative.

4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for A/E Professional and/or Owners Representative 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. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

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

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

END OF SECTION

SECTION 014100 – REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control, but not limited to, the following:

1. Description of Requirements
2. Codes and Standards
3. Governing Regulations and Authorities
4. Submittal

B. Related Sections include the following:

1. Division 1 Section "Quality Requirements"

1.3 DESCRIPTION OF REQUIREMENTS

A. General:

1. This section specifies procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the Work. These requirements include obtaining permits, licenses, inspections, releases and similar requirements associated with the regulations, codes and standards.
2. The term “Regulations” is defined to include laws, statutes, ordinances, and lawful orders issued by governing authorities, as well as those rules, conventions and agreements within the construction industry which effectively controls the performance of the Work regardless of whether they are lawfully imposed by governing authority or not.
3. Governing Authority: For requirements related to compliance with governing regulations, refer to:
    1) City of Delray Beach
    2) Palm Beach County
    3) State of Florida
    4) Health Department
4. General Requirements: Provisions and requirements of the Contract, the General Conditions of the Contract, the Supplementary Conditions of the Contract, and other Division 1 specification sections apply to the entire Work defined by the Construction Documents. As such, there is no need to separately enumerate the application of those documents within the individual specification sections or the drawings.

1.4 DEFINITIONS

A. Certain terms used in the Construction Documents are defined in this Section. Definitions and explanations contained in this Section are not necessarily complete but are general for the Work to the extent that they are not stated more explicitly in another document within the Construction Documents.

1. Indicated: refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in Specifications, and similar requirements in Construction Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help locate the reference; no limitation on location is intended except as specifically noted.

2. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the A/E Professional and/or Owners Representative ", "requested by the A/E Professional and/or Owners Representative ", and similar phrases. However, no implied meaning shall be interpreted to extend the A/E Professional and/or Owners Representative responsibility into the Construction Manager 's area of construction supervision.

3. Approve: The term "approved," where used in conjunction with the A/E Professional and/or Owners Representative action on the Construction Manager's submittals, applications, and requests, is limited to the duties and responsibilities of the A/E Professional and/or Owners Representative as stated in the Contract, General and Supplementary Conditions of the Contract or other Division 1 Specifications. Such approval shall not release the Construction Manager from responsibility to fulfill Contract requirements unless otherwise provided in the Construction Documents.

4. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."

5. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

6. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

7. Project Site: is the space available to the Construction Manager for performance of construction activities, either exclusively or in conjunction with others performing other construction activities as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.

8. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.5 CODES AND STANDARDS

A. Except where earlier editions are specifically indicated, latest editions with current revisions and amendments of the following codes and standards are considered minimum requirements for materials, workmanship and safety where not covered elsewhere in these specifications.

B. Codes and Standards:

1. Obtain copies of the following regulations (unless otherwise indicated) and retain at the project site, available for reference by parties who have a reasonable need for such reference:

a. Florida Building Code – 2020, with latest revisions.

b. Florida Fire Prevention Code – 2020, with latest revisions.

c. National Electric Code – 2020 edition, with latest revisions.

d. ASCE 7-10

e. OSHA safety standards.

1.6 GOVERNING REGULATIONS/AUTHORITIES FEES

A. Coordinate inspections and regulatory requirements of the agencies specified above under provisions of Division 1 Section "Quality Requirements".

B. Construction Manager shall obtain all permits.

1. City will pay for City of Delray Beach Building Permit fees. Review / Permit fees for all other agencies and all re-inspection fees will be paid by the Construction Manager.

2. All impact fees to the County or other agencies will be paid by the Construction Manager and reimbursed by City. If not waived by County or City.

1.7 SUBMITTALS

A. Licenses and Certificates: Submit copies of licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon the performance of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

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

B. Related Sections include the following:

1. Division 1 Section "Temporary Utilities."

2. Division 1 Section "Construction Waste Management."

1.3 USE CHARGES

A. General: Cost or use charges for “temporary facilities” shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Pompey Park staff, A/E Professional and/or Owners Representative, occupants of Project, testing agencies, and authorities having jurisdiction.

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

C. Water Service: Pay water service use charges for water used by all entities during construction operations.

D. Electric Power Service: Pay electric power service use charges for electricity used by all entities during construction operations.

E. Communications Service: Pay telephone and fiber optic use charges for communications connections used by all entities during construction operations.

1.4 SUBMITTALS

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

B. Provide Erosion and Sedimentation Control plan, including drawings and narrative.

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.

1.6 PROJECT CONDITIONS

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

B. Erosion Control: Construction Manager shall be responsible for designing and erecting controls as required below. Construction Manager is to coordinate requirements with the City, A/E

Professional and/or Owners Representative, and authorities having jurisdiction. All associated costs are to be borne by the Construction Manager.

1. Design sediment and erosion control plan (ESC), specific to the site that conforms to the erosion and sedimentation requirements of the United States Environmental Protection Agency (EPA) Construction General Permit, and the Document No. EPA 832/R-92-005 (latest publication), Storm Water Management for Construction Activities, Chapter 3, or local erosion and sedimentation control standards and codes, whichever is more stringent. The plan shall meet the following objectives:

    a. Prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.

    b. Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter.

2. Best Management Practices (BMPs) indicated in the ESC must be inspected and maintained regularly. Inspections are required at least once every 14 days and within 24 hours of the end of a rain event of 1/2-inch or more. Update the ESC plan as site conditions and BMPs change. Keep records of maintenance activities and any ESC modifications for review during inspection.

1.7 EXISTING CONDITIONS

A. The site is partially in use 12 hour / day, 6 days / week. The Construction Manager is required to perform the needed work for his construction effort in a way that does not disturb the function or interrupt ongoing operations. All work must be coordinated and scheduled with approval from City of Delray Beach Project Manager & staff. Construction Manager shall provide temporary chain link fencing at the perimeter of the construction area. Also provide barricades, signage, and all other means necessary to protect the public from harm. Construction Manager shall provide protected temporary access paths to all existing facilities adjacent to the construction area. Construction Manager shall frequently remove all construction debris from the protected temporary access paths and areas outside the work limits, but not less than once a day. Construction Manager shall remove temporary paths and restore those areas after the construction work is complete.

PART 2 - PRODUCTS

2.1 REFERENCE MATERIALS (N/A)

2.2 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 8-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. Provide screen mesh vision barrier. Color green or as approved by the City. Provide minimum (2) 12’ wide x 8’ high gates for construction access.

B. Field Offices, General: Will use Field Office Trailer. Provide office for Design Professional and RPR.

C. Common-Use Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

2. Conference table of sufficient size to accommodate meetings of up to 12 individuals. Note: Larger meetings will be held at the City’s Project Manager office conference room.

3. Furnish room with conference table, chairs, and 4-foot- square tack board and white board.

4. Drinking water and cups.

5. Coffee machine and supplies.

6. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.

7. Lighting

8. Codes: Construction Manager shall have a copy of the reference codes and standards, including but not limited to Florida Building Code, latest edition, on site at all times during construction.

9. Fire Extinguisher: Construction Manager shall provide and maintain in working order, at least two twenty (20) pound capacity dry chemical type fire extinguisher, suitable for Class A, B or C fires.

10. Office with min. two desks and chairs for Design and RPR.

D. 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.

E. Environmental Protection: Provide Best Management Practices environmental protection equipment to prevent air, soil, and water pollution in and around the project site. BMP's shall comply with contract specifications, FDEP regulations and FDOT standards. Construction Manager shall be solely liable and responsible for any fines issued by the regulatory agencies due to non-compliance or inadequate compliance. BMP's shall be maintained for the construction duration.

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.

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, City, 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: Install water service and distribution piping in sizes and pressures adequate for construction. Connect temporary water to municipal system as directed by authorities having jurisdiction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with 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.

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.

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. Coordinate removal or relocation of existing light poles or FPL power poles.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.

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

a. Police and fire departments.

b. Ambulance service.

c. Construction Manager's home office.

d. A/E Professional’s and/or Owners Representative office.

e. Engineers' offices.

f. City's office and Project Manager.

g. Principal subcontractors' field and home offices.

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

J. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, in common-use facilities.

1. Provide Broad Band High Speed Internet Connection in primary field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide incombustible construction for any offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.

2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to City.

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

1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for fire-fighting equipment and access to fire hydrants.

3. A temporary construction access road shall be clearly marked and used for all deliveries of equipment and materials. Vehicles shall travel at slow speeds (15 mph) when on site.

4. Arrange for the delivery of materials and equipment to the place of installation and for the removal of surplus and debris.

5. All construction must be limited to streets specifically noted or discussed in pre-construction.

C. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.

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

2. Provide (2) 4' x 8' high project signs of ¾" marine grade plywood and wood frame construction or corrugated plastic, painted, to City's design and colors. Sign shall be mounted on 4" x 4" x 10' pressure treated posts. City shall provide Construction Manager with signage design at pre-construction conference or as shown on the Construction Documents.

3. Install minimum (24) signs 24" x 24" in size, stating "CONSTRUCTION AREA, KEEP OUT."

4. Maintain and touchup signs so they are legible at all times.

D. Waste Disposal Facilities: Comply with requirements specified in Division 1 Section "Construction Waste Management."

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that 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 Division 1 Section "Summary."

2. Comply with City, County, and State FDEP and FDOT regulations.

B. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Division 2 Section "Site Clearing", and Civil Engineering Permit Set of Drawings.

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

D. Tree and Plant Protection: Comply with requirements specified in Division 32 Section 320190.23 "Tree & Shrub Preservation", and Civil Engineering Permit Set of Drawings.

E. 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. Obtain extended warranty for City. Perform control operations lawfully, using environmentally safe materials.

F. Site Enclosure Chain Link Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: On all sides containing the full extent of the work area to the edge of pavement.

    a. Install fence along back of sidewalk in the parking garage.

G. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Prior to the City taking full possession, Construction Manager will be fully responsible for replacing any items damaged, destroyed, or removed by vandalism, theft, etc.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting. Protection for work in or adjacent to any right-of-way shall comply with FDOT standards.

I. Temporary Protection: The Construction Manager shall provide safe access to and from entranceways and/or exits from existing buildings. This may include overhead protection in some areas, with planking or other means when within fenced-in work areas. Also, temporary protection shall be provided at openings through floors or roofs and at edges of slabs in construction areas.

J. The Construction Manager shall provide necessary weather protection against rain, wind, storms, or heat so as to maintain work, materials and existing building areas free from damage. Cover new work likely to be damaged at the end of each day's work.

K. All Contractors shall be responsible for the protection of adjoining areas and materials, including glass, when welding, flame cutting or performing any other operation requiring the use of flame, arcs or sparking devices in the course of the work. Use only flame-proof type tarpaulins.

L. Where construction is being performed in any area connected to existing facilities, the Construction Manager shall provide and maintain in working order, at least two twenty (20) pound capacity dry chemical type fire extinguisher, suitable for Class A, B or C fires.

3.5 OPERATION, TERMINATION, AND REMOVAL

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

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

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

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

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

1. Materials and facilities that constitute temporary facilities are property of Construction Manager. City reserves right to take possession of Project identification signs.

2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 1 Section "Closeout Procedures."

END OF SECTION

SECTION 015100 - TEMPORARY UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for temporary utilities, but is not limited to, the following:

1. Water Service and Distribution.
2. Temporary Electric Power and Light.
3. Telephone Service and Internet.
4. Storm and Sanitary Sewer.

1.3 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.

B. Implementation and Termination Schedule: Submit a schedule indicating implementation and termination of each temporary utility within 15 days of the receipt of Document (Notice to Proceed). At the earliest feasible time, when acceptable to the Project Consultant and City, change over from use of temporary service to use of the permanent service.

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:

1. Florida Building Code (Latest Edition with latest revisions)
2. Health and safety regulations.
3. Utility company requirements.
4. Police, Fire Department and Rescue Squad requirements.
5. Environmental protection regulations.

B. Comply with:

1. Comply with NFPA Code 241, "Building Construction and Demolition Operations".
2. ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition".
3. NECA Electrical Design Library "Temporary Electrical Facilities."

C. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.

D. Electrical Service:

1. Comply with NEMA, NECA and UL standards and regulations for temporary electric service.
2. Install service in compliance with National Electric Code (NFPA 70).

E. Inspections: Arrange for inspection and testing with authorities having jurisdiction under provisions of Division 1 Section "Quality Requirements".

F. Obtain required certifications and permits.

1.5 CONDITIONS OF USE

A. Keep temporary services and facilities clean and neat in appearance.

B. Operate in a safe and efficient manner.

C. Take necessary fire prevention measures.

D. Do not overload facilities or permit them to interfere with progress.

E. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide new materials; if acceptable to the City, undamaged previously used materials in serviceable condition may be used.

B. Provide materials suitable for the use intended.

C. Water: Provide potable water approved by local health authorities.

2.2 EQUIPMENT

A. Provide new equipment, if acceptable to the City.

1. Undamaged, previously used equipment in serviceable condition may be used.

2. Provide equipment suitable for use intended.

B. Water Hoses:

1. Provide 3/4" heavy-duty, abrasion resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system.

2. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets:

1. Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets.

2. Provide receptacle outlets equipped with ground fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.

D. Electrical Power Cords:

1. Provide grounded extension cords; use "hard service" cords where exposed to abrasion and traffic.

2. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.

E. Lamps and Light Fixtures:

1. Provide general service lamps of wattage required for adequate illumination.

2. Provide guard cages or tempered glass enclosures, where exposed to breakage.

3. Provide exterior fixtures where exposed to moisture.

F. Cooling / Heating Units: Provide temporary cooling / heating units, as required to maintain proper environmental conditions for the work. Provide units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary utilities and conform to the workforce composition and supervision requirements specified elsewhere.

B. Locate temporary utilities where they will serve the Project adequately and result in minimum interference with performance of the Work or existing.

C. Provide each temporary utility ready for use when needed to avoid delay.

D. Maintain and modify as required.

E. Do not remove until temporary utilities are no longer needed or are replaced by authorized use of completed permanent utility.

3.2 TEMPORARY UTILITY INSTALLATION

A. General Requirements:

1. Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.

2. Arrange with the company and City for a time when service can be interrupted, where necessary, to make connections for temporary services. The City will coordinate service interruptions with the occupants of existing facilities.

3. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked in services.

4. Coordinate with City to obtain easements to bring temporary utilities to the site, where the existing easements cannot be used for that purpose.

5. Use Charges: Cost or use charges for temporary facilities are not chargeable to the City and will not be accepted as a basis of claims for a Change Order.

B. Water Service:

1. Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

2. Sterilization: Sterilize temporary water piping prior to use.

C. Temporary Electric Power Service:

1. Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground fault interrupters and main distribution switchgear.

2. Temporary Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage.

D. Temporary Lighting:

1. Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.

2. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.

a. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft.

b. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.

c. Provide and maintain 0.25 watt/sq ft H.I.D. lighting to interior work areas after dark for security purposes.

3. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

4. Maintain lighting and provide routine repairs.

5. Permanent building lighting may not be utilized during construction.

6. Install exterior yard and sign lights so that signs are visible when Work is being performed.

E. Cellular Telephones:

1. Cellular Telephone Service: Provide temporary cellular service for the use of the Construction Manager, his employees, and subcontractors.

F. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, in common-use facilities.

1. Provide Broad Band High Speed Internet Connection in primary field office.

G. Sewers and Drainage:

1. Provide temporary sewer connections to remove effluent lawfully.

2. Connect temporary sewers to the municipal system as directed by the utility department officials.

3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.

4. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

5. Do not allow pollution or contamination of the site, adjacent properties or waterways.

3.3 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary utilities. Limit availability of temporary utilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain temporary utilities in good operating condition until removal. Protect from damage by heat, humidity, and similar elements including brief periods of unexpected cold conditions.

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

2. Protection: Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal:

1. Remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion.

2. Complete and restore permanent construction that may have been delayed because of interference with the temporary facility.

3. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

D. Prior to Substantial Completion, clean and renovate permanent facilities that have been used during the construction period.

END OF SECTION

SECTION 015213 - FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary field offices for use of A/E PROFESSIONAL AND/OR OWNERS REPRESENTATIVE, Project Manager, Threshold's/Serial Inspector.

B. Temporary field offices for use of CONSTRUCTION MANAGER.

C. Sub-contractor field office and conference room.

D. Maintenance and removal.

1.02 USE OF EXISTING FACILITIES

A. Existing facilities shall not be used for field offices.

1.03 USE OF PERMANENT FACILITIES

A. Permanent facilities shall not be used for field offices.

PART 2 PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.02 CONSTRUCTION

A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.

B. Exterior Materials: Weather resistant, finished in one color.

C. Interior Materials in Offices: Sheet type materials for walls and ceilings, prefinished or painted; resilient floors and bases.

D. Lighting for Offices: 50 fc at desk top height, exterior lighting at entrance doors.

E. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.03 ENVIRONMENTAL CONTROL

A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

2.04 CONSTRUCTION MANAGER OFFICE AND FACILITIES

A. Size: For CONSTRUCTION MANAGER'S needs and to provide space for project meetings.

B. Telephone: As specified in Section 01 50 00.

C. Furnishings in Meeting Area: Conference table and chairs to seat at least 20 persons; racks and files for Contract Documents, submittals, and project record documents.

D. Other Furnishings: CONSTRUCTION MANAGER'S option.

E. Equipment: Six adjustable band protective helmets for visitors, one 10 inch outdoor weather thermometer and rain gauge..

2.05 CITY OF DELRAY BEACH AND CONSULTANT OFFICE

A. Separate space for sole use of CITY and A/E PROFESSIONAL AND/OR OWNERS REPRESENTATIVE, with separate entrance door with new lock and two keys.

B. Area: At least 650 sq ft, with minimum dimension of 12 ft.

C. Windows: At least three, with minimum total area equivalent to 10 percent of floor area, with an operable sash and insect screen. Locate to provide views of construction area.

D. Electrical Distribution Panel: Two circuits minimum, 110 volt, 60 hz service.

E. Minimum four 110 volt duplex convenience outlets, one on each wall.

F. Telephone: As specified in Section 01 50 00.

G. Sanitary Facilities: As specified in Section 01 50 00.

H. Drinking Fountain: Convenient access by workers.

I. Furnishings:
   1. Four desks 54 by 30 inch, with three drawers and chair.
   2. One drafting table 36 by 72 inch, with one equipment drawer.
   3. One metal, double-door storage cabinet under table.
   4. Plan rack to hold working drawings, shop drawings, and record documents.
   5. Six linear ft of metal bookshelves.
   6. Four (4) swivel arm chairs.
   7. One drafting table stool.
   8. One tackboards 36 by 30 inch.

PART 3 EXECUTION

3.01 PREPARATION

A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION

A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.

B. Parking: Two hard surfaced parking spaces for use by CITY and A/E PROFESSIONAL AND/OR OWNERS REPRESENTATIVE, connected to office by hard surfaced walk.

3.03 MAINTENANCE AND CLEANING

A. Daily janitorial services for offices; periodic cleaning and maintenance for offices.

B. Maintain approach walks free of mud, and water.

3.04 REMOVAL

A. At completion of Work remove any buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

SECTION 015240 - CONSTRUCTION WASTE MANAGEMENT

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 administrative and procedural requirements for the following:

1. Salvaging nonhazardous construction waste.

2. Recycling nonhazardous construction waste.

3. Disposing of nonhazardous construction waste.

B. Minimum recycling level: As required for FGBC Silver Certification.

C. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for environmental-protection measures during construction, and location of waste containers at Project site.

2. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

3. Division 4 Section "Unit Masonry" for disposal requirements for masonry waste.

D. Construction Manager must use a City approved solid waste hauler for all Waste disposal

1. Recycling disposal can be performed by any company currently registered with the City to provide recycling services.

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. 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.

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

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

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

1.4 PERFORMANCE REQUIREMENTS

A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of minimum 95 percent by weight of total waste generated by the Work

B. Salvage/Recycle Requirements: The project requirement is to salvage and recycle as much non-hazardous construction waste as possible including the following materials:

1. Construction Waste:

a. Site-clearing waste.

b. Masonry and CMU.

c. Lumber.

d. Wood sheet materials.

e. Wood trim.

f. Metals.

g. Roofing.

h. Insulation.

i. Carpet.

j. Gypsum board.

k. Piping.

l. Electrical conduit.

m. Packaging: Regardless of salvage/recycle goal indicated 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 SUBMITTALS

A. Waste Management Plan: Submit 3 copies of plan within 7 days of date established for commencement of the Work.

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

C. 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.

D. 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.

1.6 QUALITY ASSURANCE

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

1. Recycling Company shall be locally and / or state regulated with recycling diversion rates certified by the regulating agency.

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

1.7 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for 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 site-clearing and construction waste generated by the Work. 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 on Project site where materials separation will be located.

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.

E. The plan should address what steps to take when a new contractor comes onboard and what kind of orientation they will receive, in addition to receiving a copy of the CWM plan.

F. Provide specific diversion measures to be employed. For example: 1) paneled doors from the existing offices will be reused as per the construction documents, 2) excavation rock will be crushed and used as fill onsite, or 3) shelving removed from the existing building will be donated to XYZ.

G. Name of recycling coordinator- The plan should clearly designate a Recycling Coordinator—an onsite party responsible for instructing the workers, overseeing and documenting results of the Construction Waste Management plan for the project. His/her contact information should be included in the plan.

H. Name of destination landfill - The CWM plan should include the name of the landfill and recycling center where trash will be disposed, the applicable landfill tipping fees, and the projected cost of disposing of all project waste in the landfill.

I. A copy of this Construction Waste Management plan should accompany all subcontractor agreements and the Construction Manager should contractually require all subcontractors to comply with the CWM plan's recycling/reuse/salvage requirements.

J. Documents: Prepare waste management plan.

1. A copy of the plan shall be distributed to the job site foreman, each subcontractor, the City, the A/E Professional and/or Owners Representative, Construction Manager's subconsultants and FGBC consultant.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by A/E Professional and/or Owners Representative. 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 Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Waste Management Coordinator: The Job Superintendent or other person designated by the Construction Manager shall serve as waste management coordinator, responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

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

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 Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

E. Waste Removal Company: Construction Manager must use City mandated solid waste and / or recycling company specified in City ordinance, if such ordinance exists. Construction Manager shall verify with the requirements with the City prior to submitting bid. Solid waste or recycling containers from other than approved companies shall not be brought to site under any circumstances.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
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 City's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to City.
4. Transport items to City's storage area off-site.
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.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

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

B. Recycling Requirement: A minimum of 95% of all waste generated during construction shall be recycled. Construction Manager shall submit a monthly report documenting compliance.

C. Procedures: If co-mingled recycling hauler is used, this is not a requirement. 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 they are 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 off City's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility, which is not suitable for being used as fill.

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

1. Pulverize concrete to maximum 4-inch size, for potential use in sub-base.

C. 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.

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

E. 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.

C. Gypsum Board: Stack large clean pieces on wood pallets 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.

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. Disposal: Transport waste materials off City's property and legally dispose of them.

D. Documentation: Construction Manager shall maintain a detailed log of all solid waste disposed and/or recycled. Such log shall include, but not limited to, date, types of material, name of disposal facility, measurement (by weight or cubic yards). Construction Manager shall maintain disposal tickets and shall have them available for City’s review and Audit and for submittal to FGBC for certification.

END OF SECTION

SECTION 015610 - CONSTRUCTION CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 REQUIREMENTS INCLUDED

A. Construction Manager shall enforce daily cleaning during progress of Work and enforce final cleanup prior to Substantial Completion.

1. Hazards Control:

a. Store volatile wastes in covered metal containers outside the building.

b. Remove containers from premises daily.

c. Prevent accumulation of wastes that create hazardous conditions.

d. Provide adequate ventilation during use of volatile or noxious substances.

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws:

1. Do not burn or bury rubbish or waste materials on Project Site.

2. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

3. Transport waste materials and debris across airport property in covered trucks.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use cleaning materials recommended by manufacturer or surface to be cleaned which will not create hazards to health or property and which will not damage surfaces.

B. Use green cleaning products and procedures to comply with FGBC requirements.

PART 3 - EXECUTION

3.1 CLEANING DURING CONSTRUCTION

A. Enforce cleaning to keep building, grounds, and public properties free of accumulation of waste materials, rubbish, and windblown debris resulting from construction operations.

B. Have protective covering applied on newly installed Work where reasonable required to ensure freedom from damage or deterioration at time of Substantial Completion. Enforce cleaning and maintenance on other newly installed Work as frequently as necessary through remainder of construction period.

C. Have operable components adjusted and lubricated to ensure operability without damaging effects.

D. Furnish on-site containers for collection of waste materials, debris, and rubbish.

E. Remove waste material, debris, and rubbish from Site daily.

F. Do not drop or throw materials from heights.

G. Continue enforcing cleaning daily until site is ready for occupancy.

3.2 DUST CONTROL

A. Wet down materials and rubbish to prevent blowing dust on a regular basis.

B. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.3 FINAL CLEANING

A. Provide final cleaning of the Work at time indicated, consisting of cleaning each surface or unit of Work to "clean" condition expected for a first-class building and maintenance program. Comply with manufacturer's instructions for cleaning operations. The following are examples, but not by way of limitation, of cleaning levels required:

1. Remove labels which are not required as permanent labels.
2. Clean exposed exterior hard-surfaced finishes, to dirt-free condition, free of dust, stains, films, and similar noticeable distracting substances.
3. Restore reflective surface to original reflective condition.
4. Remove debris and surface dust from limited access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, and similar spaces.
5. Broom clean concrete floors in non-occupied spaces.
6. Clean light fixtures and lamps to function with full efficiency.
7. Clean Project Site, including landscape development areas, of litter and foreign substances.
8. Sweep paved areas to broom-clean condition: remove stains, petro-chemical spills, and other foreign deposits.
9. Rake grounds that are neither planted nor paved, to smooth, even-textured surface.

B. Remove waste materials from Site daily and dispose of in a lawful manner.

C. Removal of protection:

1. Remove temporary protection devices and facilities that were installed during course of the Work to protect previous completed Work during remainder of construction period.

END OF SECTION

SECTION 016000- PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 REFERENCE STANDARDS

A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content.

B. ASTM D6866 - Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis.

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers.

D. EN 15804 - Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

E. ISO 14025 - Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures.

F. ISO 21930 - Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services.

G. NEMA MG 1 - Motors and Generators.

H. NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the City of Delray Beach, or otherwise indicated as to remain the property of the City of Delray Beach, become the property of the CONSTRUCTION MANAGER; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. See Section 01 40 00 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:
   1. Made of wood from newly cut old growth timber.
   2. Containing lead, cadmium, or asbestos.

D. Where other criteria are met, CONSTRUCTION MANAGER shall give preference to products that:
   1. Are made of vegetable materials that are rapidly renewable.
   2. Are made of recycled materials.
   3. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.

E. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

F. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named. Provide all data & specs exceeding or matching proposed. Allow 30 days for review & acceptance. Must be proposed & submitted prior to BID.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. Where is noted or allowed to submit “approved equal” CONSTRUCTION MANAGER to submit all data, documentation and specification of proposed product documenting is equal or better than specified basis of design product. Include warranty documents highlight where it

matches or exceeds original product. All proposed substitutions must be provided 30 days prior to BID for consideration preview & approvals. No substitutions allowed after BID award or approvals.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

I. CONSTRUCTION MANAGER to maintain current and log of deliveries and confirmation of received items.

3.03 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Provide off-site storage and protection when site does not permit on-site storage or protection.

1. Execute a formal supplemental agreement between City of Delray Beach and CONSTRUCTION MANAGER allowing off-site storage, for each occurrence.

I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

J. Comply with manufacturer's warranty conditions, if any.

K. Do not store products directly on the ground.

L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

N. Prevent contact with material that may cause corrosion, discoloration, or staining.

O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

P. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 017000 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.
8. Hurricane, Flood, and Other Perils Protection

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 1 Section "Submittal Procedures" for submitting surveys.
3. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of City-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

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

B. Certified Surveys: Submit 6 copies signed by land surveyor for Permit certifications.

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

D. Electronic Final Property Survey: Submit 4 USB stick drive with electronic copies of the final survey. Surveys shall be Autocad “DWG” format, Release 2000 or later, and PDF.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

   a. Description of the Work.

   b. List of detrimental conditions, including substrates.

   c. List of unacceptable installation tolerances.

   d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

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

3.2 PREPARATION

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

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

C. Review of Construction Documents and Field Conditions: Immediately on discovery of the need for clarification of the Construction Documents, submit a request for information to A/E Professional and/or Owners Representative. Include a detailed description of problem encountered, together with recommendations for changing the Construction Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation."

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 A/E Professional and/or Owners Representative promptly.

B. General: Engage a land surveyor to layout 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 dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

3. Inform installers of lines and levels to which they must comply.

4. Check the location, level and plumb, of every major element as the Work progresses.

5. Notify A/E Professional and/or Owners Representative when deviations from required lines and levels exceed allowable tolerances.

6. 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 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 A/E Professional and/or Owners Representative.

3.4 FIELD ENGINEERING

A. 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 A/E Professional and/or Owners Representative. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to A/E Professional and/or Owners Representative before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of four 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.

C. 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.

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

1. Final survey shall be prepared by the same surveying firm who prepared the property survey for the City prior to construction. Construction Manager shall be responsible for hiring and paying for the said firm.

2. Original site survey shall be updated to show all improvements made by the Construction Manager.

3. 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.

4. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

5. Survey shall be 24” x 36” sized sheet.

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 8 feet in spaces without a suspended ceiling.

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

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

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by A/E Professional and/or Owners Representative.

2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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

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

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. 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 materials more than 7 days during normal weather or 3 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.

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: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

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.

3.7 STARTING AND ADJUSTING

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

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

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: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

3.10 HURRICANE, FLOOD, AND OTHER PERILS PROTECTION

A. In the event the National Weather Service issues a Tropical Storm, Hurricane or Flood watch:

1. Construction Manager shall take immediate action to secure the building and the site.
2. Secure all loose materials, supplies, debris, equipment, etc.
3. All openings in the building exterior shall be boarded up with minimum ¾" plywood, 2 x 4 lumber, and tap-cons.
4. Any construction material or equipment that has been delivered to the site with the intent of being used for the project shall be secured within the building or within a sealed metal shipping container placed above the 100-year flood elevation.
5. Tie down construction trailer, storage shed, etc. with tie down cables secured to ground anchors.
6. Construction Manager shall make arrangements to secure pumps, dehumidifying equipment, generator, and gasoline / diesel prior to the storm in the event those items are needed for clean-up.
7. Construction Manager shall prepare a project damage assessment report no later than 72 hours after the storm conditions have ceased. A copy of the report shall be sent to the City, the A/E Professional and/or Owners Representative and the insurance company providing builder's risk / windstorm coverage.
8. Construction Manager shall prepare an updated project schedule no later than 7 days after the storm conditions have ceased. Highlight any delays to the project specifically caused by the storm event. Consideration shall be made for availability or shortage of labor, material supplies, equipment, and any delays in shipments.
9. If the National Hurricane Center issues a Hurricane Warning, Construction Manager shall cease all construction activities.

END OF SECTION

SECTION 017500 – STARTING AND TESTING OF SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify City and Commissioning Agent seven (7) days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions, which may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of responsible Construction Manager's personnel and City in accordance with manufacturers' instructions and commissioning plan.

G. When specified in individual specification sections, require manufacturer to provide an authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

1.3 SUBMITTALS

A. Submit a written report in accordance with Section 01400 that equipment or system has been properly installed, inspected, and is functioning correctly.

1.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products City's maintenance staff 14 calendar days prior to the date of Substantial Completion.

B. Demonstrate Project equipment and provide instruction by a qualified representative who is knowledgeable about the Project.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six (6) months.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with City staff in detail to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.

1.5 TESTING, ADJUSTING, AND BALANCING

A. Construction Manager will appoint, employ, and pay for services of an independent firm to perform testing, adjusting and balancing.

B. The independent firm will perform services specified in Division 1 and Technical Specifications.

C. Reports will be submitted by the independent firm to the City and A/E Professional and/or Owners Representative indicating observations and results of tests and indicating compliance or

non-compliance with specified requirements and with the requirements and with the requirements of the Construction Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017600 – PROTECTION OF INSTALLED CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls"

2. Division 1 Section "Construction Cleaning"

1.2 GENERAL REQUIREMENTS

A. Cleaning and Protection:

1. During handling and installation, clean and protect construction in progress and adjoining materials in place.

2. Apply protective covering where required to ensure protection from damage or deterioration until City occupancy.

3. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period under provisions of Division 1 Section "Construction Cleaning".

4. Adjust and lubricate operable components to ensure operability without damaging effects.

B. Limiting Exposures:

1. Take precautions and supervise construction activities to ensure that no part of the construction in progress or completed are subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

2. Where applicable, such exposures include, but are not limited to, the following construction related elements:

a. Excessive static or dynamic loading.

b. Excessive internal or external pressures.

c. Excessively high or low temperatures.

d. Thermal shock.

e. Excessively high humidity.

f. Air contamination or pollution.

g. Water.

h. Solvents.

i. Chemicals.

j. Light.

k. Radiation.

l. Puncture.

m. Abrasion.

n. Heavy traffic.

o. Soiling, staining and corrosion.

p. Bacteria.

q. Rodent and insect infestation.

r. Combustion.

s. Electrical current.

t. High speed operation.

u. Improper lubrication.

v. Unusual wear or other misuse.

w. Contact between incompatible materials.

x. Destructive testing.

y. Misalignment.

z. Excessive weathering.

aa. Unprotected storage.

bb. Improper shipping or handling.

cc. Theft.

dd. Vandalism.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Cover, protect finished building surfaces (walls, floors, ceilings, etc.), furniture, equipment and fixtures to remain from soiling or damage when selective demolition work and other construction activities are performed in rooms, which contain new elements of construction.

B. Erect; maintain dust-proof partitions and other closures as required to prevent spread of dust or fumes to portions of the building containing new construction.

3.2 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in respective Sections of Divisions 1 through 48.

B. Provide temporary and removable protection for installed products.

C. Control traffic in immediate area of installed Work to minimize damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs and other finished surfaces with durable sheet materials to protect from traffic, dirt, wear, damage, or movement of heavy objects.

F. Prohibit traffic and storage on waterproofed or roofed surfaces. If traffic or activity on such surfaces is necessary, obtain recommendation from waterproofing or roofing manufacturer and provide protection accordingly.

G. Do not allow wheeled or tracked vehicles on surfaces or areas not designed for their support or which will be otherwise damaged.

END OF SECTION

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 1 Specification Sections, apply to this Section.

1.2 PRELIMINARY PROCEDURES

A. If the date required for Substantial Completion has passed or cannot otherwise be met by the Construction Manager, the Construction Manager shall submit:

1. A request for time extension if the required date of Substantial Completion stipulated by the Construction Documents (or as modified by a City approved Change Order allowing a change in Contract Time) has passed. Construction Manager must comply with the requirements in the Agreement for requesting time extensions.

2. Provide complete details and attach substantiating evidence concerning reasons for requested Time extension.

3. Format: Submit request for time extension with associated detail sheets, in accordance with the provisions in the Agreement.

B. Before requesting inspection for certification of Substantial Completion, complete the following:

1. All air conditioning, ventilation, security systems, fire alarms, fire sprinklers and other life safety systems and building systems must be completed, tested, approved and demonstrated.

2. Air Conditioning systems test, and balance reports submitted and approved.

3. Landscape irrigation systems must be completed, tested, approved and demonstrated.

4. Master and grand master keys must be delivered in sealed containers to the City. Keys must be labeled to identify where keys are used for the finished work.

5. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in the Construction Documents and a statement showing an accounting of changes to the Contract Sum.

6. Advise City of pending insurance change-over requirements.

7. Prepare specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents for submittal under provisions of Section 017800, Closeout Submittals.

8. Obtain and submit releases enabling the City unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

9. Submit As-built drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information under provisions of Section 017800, Closeout Submittals.

10. Deliver tools, spare parts, extra stock, and similar items as specified in respective specification sections of Divisions 2 through 48 and in Section 017800, Closeout Submittals.

11. Make final change-over of permanent locks and transmit master and grand master keys to the City.

12. Advise the City's personnel of pending change-over in security provisions.

13. Complete start-up testing of systems, and instruction of the City's operating and maintenance personnel.

14. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

15. Complete final clean up requirements, including touch-up painting.

16. Touch-up and otherwise repair and restore marred exposed finishes.

17. Obtaining a Certificate of Occupancy (or, with prior written approval from the City, a Temporary Certificate of Occupancy (TCO)) from the Building Department having jurisdiction over the project.

1.3 CONSTRUCTION MANAGER 'S REQUEST FOR INSPECTION

A. When the Construction Manager considers that the Work, or a portion thereof which the City agrees to accept separately, is substantially complete, the Construction Manager shall prepare and submit to the A/E Professional and/or Owners Representative a Request for Substantial Completion Inspection including a comprehensive list of items to be completed or corrected.

B. The Construction Manager shall proceed promptly to complete and correct items on the list. Failure to include an item on such list does not alter the responsibility of the Construction Manager to complete all Work in accordance with the Construction Documents.

C. Project Closeout Submittals: Project closeout submittals required by the Construction Documents for the Work, or a portion thereof, shall be submitted by the Construction Manager at or prior to the time of his request.

1.4 CITY'S DETERMINATION OF READINESS

A. Upon receipt of the Construction Manager's Request for Substantial Completion Inspection, the City and A/E Professional and/or Owners Representative will make a preliminary inspection to determine whether the Work or designated portion thereof is appropriately ready for a Substantial Completion Inspection.

B. The A/E Professional and/or Owners Representative will notify the Construction Manager of the results of his inspection by completing and distributing the A/E Professional and/or Owners Representative Notification of Readiness for Substantial Completion Inspection.

1. If the City and A/E Professional and/or Owners Representative inspection discloses any item, whether or not included on the Construction Manager's list, which is not in accordance with the requirements of the Construction Documents and which would preclude beneficial occupancy and would render the Work not Substantially Complete, the Construction Manager shall correct such item upon receipt of the A/E Professional and/or Owners Representative Notification. The Construction Manager shall then submit another request for inspection by the City and A/E Professional and/or Owners Representative to determine the completion status of the Work or designated portion thereof.

1.5 SUBSTANTIAL COMPLETION INSPECTION

A. The Substantial Completion Inspection will be conducted by the City and A/E Professional and/or Owners Representative, and the Construction Manager.

B. The following representatives shall attend and conduct the Substantial Completion Inspection:

1. Construction Manager Personnel:

a. Project Manager

b. Superintendent

c. Plumbing Superintendent

d. Mechanical Superintendent

e. Electrical Superintendent

f. Specialty Sub- Construction Manager.

2. City Personnel:

a. Project Manager

b. Field Construction Personnel and/or Supervisors

c. City's Professional Staff

d. City's Test Maintenance Staff

e. Other specialty representatives of the City.

3. A/E Professional and/or Owners Representative Personnel

a. Architectural Project Manager

b. Architectural Special Project Representative/Field Representative

c. Structural Engineer

d. Mechanical Engineer

e. Electrical Engineer

f. Technology Engineer

g. Specialty Sub-consultants

h. Commissioning Agent

C. Inspection Teams:

1. At the direction of the City, inspection teams will be established at the project site based upon the following disciplines:

a. Architectural/Civil

b. Plumbing

c. Mechanical

d. Electrical

e. Technology

f. Specialties

2. Each inspection team will be composed of specialty representatives of the City, A/E Professional and/or Owners Representative and Construction Manager, who will perform independently of each other.

3. Each team will appoint a Team Leader.

4. The Construction Manager will provide each Team Leader with:

a. Copy of the Construction Manager's List of Deficiencies

b. Floor and site plans with the remainder of the Construction Documents available to the team.

D. At the Completion of the Substantial Completion Inspection, the City will issue a Substantial Completion Inspection report and Substantial Completion Punch List.

E. If Substantial Completion of the Work, or portion thereof, is denied, the Construction Manager shall promptly correct deficiencies noted which caused the denial of substantial completion. Upon correcting these deficiencies, the Construction Manager shall notify the City that these deficiencies are ready for re-inspection by submitting a new Request for Substantial Completion at which time the City, A/E Professional and/or Owners Representative, and Construction Manager will re-conduct the Substantial Completion Inspection for substantial completion deficiencies only.

F. When Substantial Completion of the Work, or portion thereof, is granted, the City will prepare and issue Certificate of Substantial Completion to indicate the date of substantial completion.

1.6 READINESS FOR FINAL COMPLETION (ACCEPTANCE) INSPECTION

A. Deficiencies noted on or attached to Substantial Completion Inspection Report and Substantial Completion Inspection Punch List, must be completed prior to the City's Final Completion Inspection. Limitations on the Time during which these corrections must be made shall be consistent with the Time specified in the Contract.

B. Upon correction of the punch list, the Construction Manager shall notify the City and issue a Request for Final Completion Inspection, that the Work, or portion thereof is ready for the Final Completion Inspection.

C. Upon receipt of the Construction Manager's Request for Final Completion Inspection, the City and A/E Professional and/or Owners Representative will make an inspection to determine whether the Work or designated portion thereof is complete. The A/E Professional and/or Owners Representative will notify the Construction Manager of the results of his inspection by completing and distributing the A/E Professional and/or Owners Representative Notification of Readiness for Final Completion Inspection.

1. If the City and A/E Professional and/or Owners Representative inspection discloses any item which is not in accordance with the requirements of the Construction Documents and which would render the Work not complete, the Construction Manager shall correct such item upon receipt of the A/E Professional and/or Owners Representative Notification of Readiness for Final Completion Inspection. The Construction Manager shall then submit another request for inspection by the City and A/E Professional and/or Owners Representative to determine the completion status of the Work or designated portion thereof.

1.7 FINAL COMPLETION INSPECTION

A. The Final Completion Inspection will be conducted by the City, the A/E Professional and/or Owners Representative, and the Construction Manager.

1. Members of the inspection teams which inspected the facility for Substantial Completion will reconvene to conduct the Final Completion Inspection.

2. Members of the inspection teams for which there are no outstanding Punch List Items may be excused upon request to and approval by the City.

B. If Final Completion of the Work, or portion thereof, is denied, the Construction Manager shall promptly correct deficiencies noted which caused the denial of final completion.

C. Upon correcting these deficiencies, the Construction Manager shall notify the City that these deficiencies are ready for re-inspection (by submitting a new Construction Manager's Request

for Final Completion Inspection at which time the City, A/E Professional and/or Owners Representative, and Construction Manager will re-conduct the Final Completion Inspection).

1.8 FINAL COMPLETION DATE

A. When Final Completion of the Work, or portion thereof, is granted, the City will issue the Letter Establishing Final Completion Date to indicate the date of final completion.

B. Upon receipt of City's Letter Establishing Final Completion Date, the Construction Manager may make application for final payment.

C. If correction of Punch List is not fully completed within a period twice as long as that allowed by the Construction Documents, at his option, may close out the Work or designated portion thereof, by deducting his estimate of the cost to correct the outstanding items and complete with Work by a separate Contractor or the City's own forces.

1.9 OCCUPANCY INSPECTION

A. The Municipal or County Building Departments having jurisdiction will conduct an inspection for the purpose of determining that the Work, or portion thereof, is in compliance with the statutes, rules, and codes affecting the health and safety of the occupants.

B. Upon successful completion of this inspection, the jurisdictional Building Department will issue a Certificate of Occupancy authorizing occupancy of the Work, or portion thereof.

1. The Construction Manager shall be responsible for corrections to discrepancies noted by the jurisdictional Building Department during the Occupancy Inspection.

C. Obtaining a Certificate of Occupancy from the Jurisdictional Building Department is a pre-requisite to the Construction Manager achieving Substantial Completion.

1.10 FINAL ADJUSTMENTS OF ACCOUNTS

A. Submit a final statement of accounting to the City.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.

2. Additions and deductions resulting from:

a. Previous Change Orders.

b. Deductions for uncorrected work.

c. Deductions for liquidated damages.

d. Deductions for re-inspection payments.

e. Other adjustments.

3. Total Contract Sum, as adjusted.

4. Previous payments.

5. Sum remaining due.

6. The applicable Purchase Order Number issued by the City.

1.11 FINAL APPLICATION FOR PAYMENT

A. Submit the final Application for Payment in accordance with procedure and requirements stated in the Construction Manager’s agreement with the City.

1.12 REINSPECTION FEES

A. Construction Manager shall pay for all reinspection fees.

1.13 PUNCH LIST COMPLETION

A. The facilities may be occupied by City during completion of all or a portion of the Punch List.

B. Complete Punch List work during the City's normal hours of operation (7:00 AM to 6:00 PM Monday through Thursday).

C. Make arrangements concerning access and other than normal work hours with the City.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017800 – CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for closeout submittals, including the following:

1. Operation and Maintenance Data
2. Maintenance Materials
3. Product Warranties
4. Product Bonds
5. Project Record Documents
6. Spare Parts
7. Electronic Media
8. Miscellaneous Schedules

B. Related Sections include the following:

1. Division 1 Section "Submittal Procedures"
2. Division 1 Section "Closeout Procedures"
3. Division 1 Section "Project Record Documents"
4. Division 1 Section "Operation and Maintenance Data"
5. Division 1 Section "Demonstration and Training"

1.3 SUBMITTALS

A. Project closeout submittals required by the Construction Documents for the Work, or a portion thereof, shall be submitted by the Construction Manager at or prior to the time of his request for the A/E Professional and/or Owners Representative inspection unless otherwise specified in this Section or elsewhere in the Construction Documents.

B. A/E Professional and/or Owners Representative (assisted by the City's Commissioning Agent, Test and Balance Consultant and others as applicable) will review project closeout submittals with the City for content, accuracy, and format:

1. If the A/E Professional and/or Owners Representative disapproves or rejects any project closeout submittal, it shall be returned to the Construction Manager for correction and modification.
2. The Construction Manager shall then submit his revised and corrected project closeout submittals to the A/E Professional and/or Owners Representative for review and approval.
3. The Construction Manager shall continue to revise and resubmit project closeout submittals until all required submittals have been accepted by the Project Consultant.

4. The A/E Professional and/or Owners Representative will forward approved project closeout submittals to the City prior to the City's Substantial Completion Inspection.

5. Corrections or modifications of Project Closeout Submittals shall not be used as justification for an extension of Time.

C. Submit closeout submittals under provisions of Division 1 Section "Submittal Procedures", with content and in formats specified within this Section and elsewhere in the Construction Documents

1.4 OPERATION AND MAINTENANCE DATA

A. Quality Assurance:

1. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

B. Organization: Unless otherwise indicated, organize each manual into separate sections. Each manual shall contain the following materials, in the order listed:

1. Title page.

2. Table of contents.

3. Manual contents.

C. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.

2. Name and address of Project.

3. Name and address of City.

4. Date of submittal.

5. Name, address, and telephone number of Construction Manager.

6. Name and address of Architect.

7. Cross-reference to related systems in other operation and maintenance manuals.

D. Format:

1. Prepare data in the form of an instructional manual.

2. Bind in commercial quality 8-1/2-inch x 11-inch three D side ring binders with durable plastic covers, 3 inch maximum ring size:

a. When multiple binders are used, correlate data into related consistent groupings.

b. Provide sheet lifters for front and back of binder.

c. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

d. Index Tab Dividers:

1) Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.

2) Provide index tab sheet identified as “Contents” in front of the first page of the table of contents to prevent laser printer or copier toner from sticking to vinyl binder.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.

4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.

5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts. Provide Photo reduced 11" x 17" copies folded in half of the as-built record drawings.

   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations

E. Contents, Each Volume:

1. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Project Consultant, Sub-Consultants, and Construction Manager with name of responsible parties; schedule of products and systems, indexed to content of the volume.

   a. If record documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

2. For Each Product or System: List names, addresses and telephone numbers of Sub-Consultants and suppliers, including local source of supplies and replacement parts and applicable local maintenance Construction Manager.

3. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

4. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

5. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

6. Warranties: Bind in copy of each.

F. Manual for Materials and Finishes:

1. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured Products.

2. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

3. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

4. Additional Requirements: As specified in individual Product specification sections.

5. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

G. Manual for Equipment and Systems:

1. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting

conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

2. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

3. Include color-coded wiring diagrams as installed.

4. Operating Procedures:

   a. Include start-up, break-in, and routine normal operating instructions and sequences.

   b. Include regulation, control, stopping, shutdown, and emergency instructions.

   c. Include summer, winter, and any special operating instructions.

5. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

6. Provide servicing and lubrication schedule, and list of lubricants required.

7. Include manufacturer's printed operation and maintenance instructions.

8. Include sequence of operation by controls manufacturer.

9. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

10. Provide control diagrams by controls manufacturer as installed.

11. Provide Construction Manager's coordination drawings, with color-coded piping diagrams as installed.

12. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

13. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

14. Additional Requirements: As specified in individual Product specification sections.

15. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

H. Instruction of City Personnel:

1. Provide copies of all instructional materials, including video taped documentation of training sessions or other instructional audio-visual materials, as specified in Division 1 Section "Demonstration and Training" and other locations in the Construction Documents.

2. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

I. Submittals:

1. Review Copy:

   a. Submit 1 copy of completed volumes (30) days prior to submitting Construction Manager's Request for Substantial Completion Inspection.

   b. This copy will be reviewed and returned with comments by the A/E Professional and/or Owners Representative, the City, and other City consulting reviewers as applicable.

c. Revise content of all document sets as required by comments provide by the A/E Professional and/or Owners Representative and the City prior to final submission.

2. Final Submittals:

a. Submit (5) sets of revised final volumes in final form prior to submitting G Construction Manager's Request for Substantial Completion Inspection.

b. In additional to hard copies, scan and submit (5) sets of the closeout documents on DVD-ROMs in PDF format.

1.5 MAINTENANCE MATERIALS

A. Submit maintenance materials, equipment and accessories of the types and in the quantities specified within the respective specification Sections of Divisions 2 through 48.

B. Provide maintenance materials, equipment and accessories in original manufacturer's packaging with manufacturer's original, clearly legible labeling.

C. Coordinate delivery date and final storage location of maintenance materials, equipment and accessories to the City through the A/E Professional and/or Owners Representative prior to submittal of Construction Manager's Request for Substantial Completion Inspection.

D. Do not utilize maintenance materials or equipment for cleaning, maintenance or other Construction Manager operations.

E. Test and inspect maintenance materials, equipment and accessories to ensure operability, fitness for purpose and new condition prior to submitting to the City.

1.6 PRODUCT WARRANTIES

A. Summary:

1. This article specifies general administrative and procedural requirements for warranties required by the Construction Documents, including manufacturers standard warranties on products and special warranties.

a. Refer to Construction Documents for terms of the Construction Manager's special warranty of workmanship and materials.

b. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions 2 through 48.

2. Disclaimers and Limitations: Manufacturer's exclusions, disclaimers and limitations on product warranties do not relieve the Construction Manager of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the General Construction Manager.

B. Definitions:

1. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the City.

2. Special Warranties:

a. Are written warranties required by or incorporated in the Construction Documents, either to extend time limits provided by standard warranties or to provide greater rights for the City.

b. Refer to individual Sections of Divisions 2 through 48 for specific content requirements, standard form documents, and particular requirements for submittal of special warranties.

C. Warranty Requirements

1. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

2. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

3. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Construction Documents. The Construction Manager is responsible for the cost of replacing or rebuilding defective Work regardless of whether the City has benefited from use of the Work through a portion of its anticipated useful service life.

4. City's Recourse: Written warranties made to the City are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the City can enforce such other duties, obligations, rights, or remedies.

5. Rejection of Warranties: The City reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Construction Documents.

6. The City reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

D. Submittals:

1. Draft Copies:

a. When a warranty document is required to be executed by the Construction Manager, or the Construction Manager and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the City through the A/E Professional and/or Owners Representative for approval.

b. Forms for special warranties are included in the Project Manual in the respective Sections of Divisions 2 through 48 or are available through the Project Consultant. Prepare a written document utilizing the appropriate form, ready for execution by the Construction Manager, or the Construction Manager and subcontractor, supplier or manufacturer. Submit a draft to the City through the A/E Professional and/or Owners Representative for approval.

c. Submit draft copies of all proposed final warranty documents to the A/E Professional and/or Owners Representative under provisions of Division 1 Section "Submittal Procedures", for the City and A/E Professional and/or Owners Representative review.

d. Edit warranty documents to make them project specific for the City.

e. Remove exclusions, disclaimers and limitations on product warranties not allowed by the Construction Documents.

f. Include terms and conditions in addition to the “standard” warranty as may be required by the Construction Documents.

g. Catalog copies or other “sample” warranty forms not presented in project specific format for the City shall be resubmitted.

2. Form of Submittal:

a. Prior to Substantial Completion compile (5) five copies of each required warranty properly executed by the Construction Manager, or by the Construction Manager, subcontractor, supplier, or manufacturer.

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

c. Bind in commercial quality 8-1/2 x 11-inch three D side ring binders with durable plastic covers, 3 inch maximum ring size:

1) Provide sheet lifters for front and back of binder.

2) Cover: Identify each binder with typed or printed title WARRANTIES with title of Project; name, address and telephone number of Construction Manager and name of responsible company principal.

3) Table of Contents:

a) Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of Product or work item.

b) Provide index tab sheet identified as “Contents” in front of the first page of the table of contents to prevent laser printer or copier toner from sticking to vinyl binder.

4) Separate each warranty with index tab sheets keyed to the Table of Contents listing.

a) Provide full information, using separate typed sheets as necessary.

b) List subcontractor / Construction Manager, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

d. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty documents, as necessary, for inclusion in each required manual.

E. Timing of Submittals:

1. Draft warranty documents: Submit with shop drawings, product data or samples as otherwise required for the specified product. If no other submittals are required for a specific product, submit required draft warranty documents in a timely manner prior to delivery and installation of the product on the site.

2. Submit final warranty documents to the A/E Professional and/or Owners Representative not later than (7) days after the date of Substantial Completion for the Work or a portion thereof as established on the Project Consultant’s executed Consultant's Letter Establishing Substantial Completion Date.

3. If the City's executed Letter Establishing Substantial Completion Date designates a commencement date for warranties other than the date of Substantial Completion for the

Work, or a designated portion of the Work, submit written warranties upon request of the City.

4. When a designated portion of the Work is completed and occupied or used by the City, by separate agreement with the Construction Manager during the construction period, submit properly executed warranties to the A/E Professional and/or Owners Representative within (7) days of completion of that designated portion of the Work.

1.7 PROJECT RECORD DOCUMENTS

A. General Requirements:

1. Do not use record documents for construction purposes.

2. Protect from deterioration and loss in a secure, fire resistive location.

3. Provide access to record documents for reference by the A/E Professional and/or Owners Representative, the City, and other City related personnel during normal working hours.

4. Make project record documents available for inspection by jurisdictional authorities at all times.

5. Ensure special protection of project record documents.

B. Maintain at the site for the City one record copy of:

1. Drawings.

2. Specifications.

3. Addenda.

4. Change Orders, Project Consultant’s Supplementary Instructions and other modifications to the Contract.

5. Approved submittals including all administrative submittals as may be required in the Project Manual.

6. Field Test Records and Reports.

7. Construction Photographs.

C. Maintenance of Project Record Documents:

1. Store documents, samples in Construction Manager's field office apart from documents used for construction.

a. Provide fire resistive files and racks for storage of documents.

b. Provide locked fire resistive cabinets or secure storage spaces for storage of samples.

2. Filing Organization:

a. File information concerning individual products according to the 1995 edition of MasterFormat as published by the Construction Specifications Institute.

b. File information concerning assemblies and systems according to the CSI/CSC UniFormat as published by the Construction Specifications Institute, edition current upon Notice to Proceed date.

3. Maintain documents in a clean, dry, legible condition and in good order.

D. Record Drawings:

1. Maintain a clean, undamaged set of blue or black line on white prints of Construction Documents and Shop Drawings.
2. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown.
3. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Construction Documents.
4. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
5. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
6. Mark new information that is important to the City but was not shown on Construction Documents or Shop Drawings.
7. Note related Change Order numbers where applicable.
8. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
9. 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 Construction Documents.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

E. Record Specifications:

1. Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction.
2. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
3. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation.

4. Note related record drawing information and Product Data.

5. Upon completion of the Work, submit record Specifications to the A/E Professional and/or Owners Representative for the City's records.

F. Record Product Data:

1. Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted.

2. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations.

3. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation.

4. Note related Change Orders and markup of record drawings and Specifications.

5. Upon completion of markup, submit complete set of record Product Data to the A/E Professional and/or Owners Representative Team for the City's records.

G. Record Testing Data / Certifications

1. Record Testing Data / Certifications: Construction Manager shall submit (5) sets of signed and sealed reports prepared during the course of the construction. Testing Data shall include, but not limited to:

a. Soils compaction and density.

b. Concrete cylinder tests.

c. Structural threshold inspector in-progress inspections.

d. Structural threshold inspector final structural certifications.

e. Structural welding certification.

f. Insulation certification.

g. As-built site lighting photometric plan.

h. Mechanical test and balance report.

i. Flow test.

j. Fire alarm system certification.

k. Lightning detection system certification.

l. Surge and lightning protection system certification.

m. Fire suppression system certification.

n. Total building commissioning report.

o. Flood plain elevation certification.

p. Storefront testing

H. Record Sample Submitted:

1. Immediately prior to the date or dates of Substantial Completion, the Construction Manager will meet at the site with the A/E Professional and/or Owners Representative and the City's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the City for record purposes.

2. Comply with delivery to the City's Sample storage area.

I. Record Cad As-Built Drawings:

1. Update all Electronic Construction Document CAD Drawings for all construction deviations and submit copies of the drawings to the City in native CAD and PDF formats.

a. All redline markup shown on the field record set shall be incorporated into the electronic files at the end of the construction phase.

b. Include Civil As-built final survey with site and utility improvements.

J. Miscellaneous Record Submittals:

1. Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work.

2. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference.

3. Submit to the A/E Professional and/or Owners Representative for the City's records.

1.8 SPARE PARTS

A. Submit spare parts and related accessories of the types and in the quantities specified within the respective specification Sections of Divisions 2 through 48.

B. Provide spare parts in original manufacturer’s packaging with manufacturer’s original, clearly legible labeling.

C. Coordinate delivery date and final storage location of spare parts through the A/E Professional and/or Owners Representative prior to submittal of Construction Manager's Request for Substantial Completion Inspection.

D. Do not utilize spare parts for any purpose during construction.

E. Test and inspect spare parts to ensure operability, fitness for purpose and new condition prior to submitting to the City.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017810 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Record Testing Data / Certifications
5. Record REVIT/CAD As-built Model / Drawings

B. Related Sections include the following:

1. Division 1 Section "Closeout Procedures" for general closeout procedures.
2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 2 through 48 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit two (2) set(s) of marked-up Record Prints.

B. Record Specifications: Submit two (2) copies of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit two (2) copies of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

D. Record Testing Data: Submit two copies of record testing data, each test and each copy signed and sealed by testing agency or professional engineer.

E. REVIT/CAD As-built Record Drawings for all disciplines: Submit two (2) USB Flash Drives copies.

F. Two sets of Civil as-built drawings need to be submitted on 24”x36” size paper and 1 USB Flash Drive containing REVIT/AutoCad files.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

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 prepare the 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 understandable drawing technique.

    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

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 or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

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. 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. Identification: As follows:

    a. Project name.

b. Date.

c. Designation "PROJECT RECORD DRAWINGS."

d. Name of Architect.

e. Name of Construction Manager.

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.

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.

2.4 RECORD TESTING DATA / CERTIFICATION

A. Record Testing Data / Certifications: Construction Manager shall submit (2) sets of signed and sealed reports prepared during the course of the construction. Testing Data shall include, but not limited to:

1. Soils compaction and density.

2. Concrete cylinder tests.

3. Asbestos tests / asbestos free material certifications.

4. Structural threshold inspector in-progress inspections.

5. Structural threshold inspector final structural certifications.

6. Structural welding certification.

7. Insulation certification.

8. As-built site lighting photometric plan.

9. Mechanical test and balance report.

10. Fire flow test.

11. Fire alarm system certification.

12. Lightning detection system certification.

13. Surge and lightning protection system certification.

14. Fire suppression system certification.

15. Total building commissioning report.

16. Flood plain elevation certification.

17. Storefront testing

2.5 RECORD REVIT/CAD AS-BUILT DRAWINGS

A. Update all Electronic Construction Document REVIT/CAD Drawings for all construction deviations and submit copies of the drawings to the City in native REVIT/CAD and PDF formats.

1. All redline markup shown on the field record set shall be incorporated into the electronic files at the end of the construction phase.

2. Include Civil As-built final survey with site and utility improvements.

2.6 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.

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 modifications to Project Record Documents as they occur; do not wait until the 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.

3.2 RECORD DOCUMENTATION MANUAL

A. Organization: Include a section in the manual for each of the following:

1. Table of Contents.

2. Record Drawings.

3. Record Specifications.

4. Record Product Data.

5. Record Testing Data / Certification.

6. REVIT/CAD As-builts.

7. Miscellaneous Record Submittals.

B. Tables of Contents: Include a table of contents for each record manual.

3.3 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into separate sections. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of City.
4. Date of submittal.
5. Name, address, and telephone number of Construction Manager.
6. Name and address of Architect.
7. 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 record 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.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    a. If two or more binders are necessary to accommodate data, organize data in each binder into groupings by sections.
    b. Identify each binder on front and spine, with printed title "RECORD DOCUMENTATION MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts. Provide Photo reduced 11 x 17 copies folded in half of the as-built record drawings.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in

manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

END OF SECTION

SECTION 017820 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This 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. Maintenance manuals for the care and maintenance of products, materials, and finishes; systems and equipment.

B. Related Sections include the following:

1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
3. Division 1 Section "Closeout Submittals" for preparing Record Drawings for operation and maintenance manuals.
4. Divisions 2 through 48 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

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 SUBMITTALS

A. Initial Submittal: Submit 1 draft copy of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. A/E Professional and/or Owners Representative will return one copy of draft and mark whether general scope and content of manual are acceptable.

1. Correct or modify each manual to comply with A/E Professional and/or Owners Representative comments. Submit (5) five copies of each corrected manual within 15 days of receipt of A/E Professional and/or Owners Representative comments.

B. Final Submittal: Submit (5) five copies of each manual in final form at least 15 days before final inspection.

1.5 COORDINATION

A. Where operation and maintenance documentation include information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: 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 MANUALS, GENERAL

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. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of City.
4. Date of submittal.
5. Name, address, and telephone number of Construction Manager.
6. Name and address of A/E Professional and/or Owners Representative.
7. 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 or multiple binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary, to provide essential information for proper operation or maintenance of equipment or system.

b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.

4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.

5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

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 City'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.
2. Performance and Construction Documents if Construction Manager is 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.
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.

PRODUCT MAINTENANCE MANUAL

F. 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.

G. 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.

H. 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.

I. 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.

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

K. 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.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

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.

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

1. Standard printed 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 videotape, 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 City'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 City'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 Division 1 Section "Project Record Documents."

G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 018100 – COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Construction Manager 's responsibilities for commissioning:

1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Construction Manager are utilized to achieve this.

2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests executed by Construction Manager and witnessed by the Commissioning Authority are utilized to achieve this.

B. Commissioning Functional Tests is to occur after startup and initial checkout and be completed before punch lists are performed and testing and balancing is complete.

C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

1.2 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. HVAC System, including:

1. HVAC System units

2. AHUS and Energy Recovery Units

3. Computer Room AC Units and Condensing Units

4. Exhaust Fans

5. Control System

6. Test and Balance Review

7. Lighting Controls

8. C.O.P.S. Power System (LR).

9. Generator

10. ATS (LR).

11. UPS (LR).

1.3 RELATED SECTIONS

A. Section 018150 - Commissioning Authority Responsibilities

1.4 SUBMITTALS

A. See Section 013300 – Submittal Procedures, for submittal procedures; except:

1. Submit one copy of all shop drawings of the equipment listed above to the Commissioning Authority, not to be returned.

2. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists

B. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

C. Product Data: If submittals to A/E Professional and/or Owners Representative do not include the following, submit copies as soon as possible:

1. Manufacturer's product data, cut sheets, and shop drawings.
2. Manufacturer's installation instructions.
3. Startup, operating, and troubleshooting procedures.
4. Fan curves.
5. Factory test reports.
6. Warranty information, including details of City's responsibilities in regard to keeping warranties in force.

D. Startup Plans and Reports.

E. Completed Pre functional Checklists.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing, equipment will NOT become the property of City.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5-degree F (0.3 degree C) and resolution of plus/minus 0.1-degree F (0.05 degree C).
2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
3. Calibration: According to the manufacturer’s recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to City; such equipment, tools, and instruments are to become the property of City.

PART 3 - EXECUTION

3.1 COMMISSIONING PLAN

A. Commissioning Authority will prepare the Commissioning Plan.

1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. The Construction Manager is responsible for coordination and compliance with the Commissioning Plan and schedules.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:

1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.

2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.

3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.

4. Provide sufficient notice to the Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.2 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.3 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.

1. No sampling of identical or near-identical items is allowed.

2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.

3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:

(a) Certification by installing Construction Manager that the unit is properly installed, started up, and operating and ready for Functional Testing.

(b) Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.

(c) Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."

(d) Serial number of installed units.

(e) List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.

(f) Sensor and actuator calibration information.

B. The Construction Manager is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.

1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.

2. Checklists with incomplete items may be submitted for approval provided the Construction Manager attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.

3. Individual Checklists may contain line items that are the responsibility of more than one installer; Construction Manager shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.

4. If any Checklist line item is not relevant, record reasons on the form.

5. Construction Manager may independently perform startup inspections and/or tests, at his option; see Section 01700 for additional general startup requirements.

6. Regardless of these reporting requirements, Construction Manager is responsible for correct startup and operation.

7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority Witnessing: Required for:

1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.

2. A sampling of non-primary equipment as allowed by the commissioning plan.

D. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to City.

1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.4 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned.

B. Construction Manager is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Construction Manager is responsible for correction of deficiencies and re-testing at no extra cost to City; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Construction Manager's stated intentions regarding correction.

1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.

2. When the deficiency has been corrected, the Construction Manager completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Construction Manager shall re-test.

3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.

4. The Construction Manager shall bear the cost of City and Commissioning Authority personnel time witnessing re-testing.

5. Construction Manager shall bear the cost of City and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Construction Manager shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:

1. Some test procedures are included in the Contract Documents; where Functional Test procedures are not included in the Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Construction Manager.

2. Functional Testing: Drafts of the Functional Tests are provided at the end of this section.

3.5 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by City beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

3.6 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute the starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

D. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example, apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

E. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

F. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

G. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

H. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems, where monitoring of specific points is called for in Functional Test Procedures:

1. All points that are monitored by the relevant control system shall be trended by the Construction Manager; at the Commissioning Authority’s request, Construction Manager shall trend up to 20 percent more points than specified at no extra charge.

2. Other points will be monitored by the Commissioning Authority using dataloggers.

3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
5. Graphical output is desirable and is required for all output if the system can produce it.
6. Monitoring may be used to augment manual testing.

END OF SECTION

SECTION 018113 – SUSTAINABLE DESIGN AND CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general requirements and procedures for achievingthe most environmentally conscious Work possible within the limits of the Construction Schedule, Contract Sum, and available materials, equipment, and products.

B. This Project is seeking certification with the Florida Green Building Coalition ("FGBC") and is pursuing, at a minimum, a Silver level certification under FGBC's Commercial Building Standard Version 3/Revision 1, being referred to hereinafter as the ("Project Certification"). FGBC Certification is a requirement of the City of Delray Beach for the Pompey Recreation Center, and for compliance with the City of Delray Beach Land Development Regulations Ordinance No. 30-22, Green Building. See list of applicable credits and attached preliminary project evaluation checklist at the end of this section. This checklist is subject to updates throughout the project. The Construction Manager is responsibility for meeting the requirements of this section.

1.2 OBJECTIVES

A. To meet the requirements of the Pompey Recreation Center, the City of Delray Beach, and the pursuit of a State of Florida recognized green building rating system in order to meet green building goals, including energy & water efficiency, obtain acceptable Indoor Air Quality (IAQ) for the completed project, and minimize the environmental impacts of the construction and operation, the Construction Manager during the construction phase of this project shall implement the following procedures singly or in combination:

1. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy and minimize amounts of pollution to produce, and employ recycled and/or recyclable materials. To help government purchasers incorporate environmental considerations into purchasing decisions, it is the intent of this project to conform with EPA's Five Guiding Principles on environmentally preferable purchasing. The five principles are:

   a. Include environmental considerations as part of the normal purchasing process.

   b. Emphasize pollution prevention early in the purchasing process.

   c. Examine multiple environmental attributes throughout a product's or service's life cycle.

   d. Compare relevant environmental impacts when selecting products and services.

   e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.

2. Control sources for potential IAQ pollutants by controlled selection of materials and processes used in project construction in order to attain superior IAQ.

3. Products and processes that achieve the above objectives to the extent

currently possible and practical have been selected and included in these Construction Documents. The Construction Manager is responsible for maintaining and support these objectives in developing means and methods for performing the work of this Contract and inproposing product substitutions and/or changes to specified processes.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. Divisions 2 through 48 Sections for Sustainable Design Requirements specific to the Work of each of those Sections.

1.4 DEFINITIONS

A. Agrifiber Products: Composite panel products derived from agricultural fiber

B. Biobased Product: As defined in the 2002 Farm Bill, a product determinedby the Secretary to be a commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials

C. Biobased Content: The weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight

D. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products has been tracked through its extraction and fabrication to ensure that it was obtained from forests certified by a specified certification program

E. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder

F. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations. A construction waste management plan is to be provided by the Construction Manager for review within 20 days of notice to proceed and must be in accordance with FGBC 3.1 Commercial rating system.

G. Florida Green Building Coalition 'FGBC': The Florida Green Building Coalition (FGBC) is a nonprofit 501(C)3 Florida corporation dedicated to improving the built environment. Their mission is to lead and promote sustainability with environmental, economic, and social benefits through regional education and certification programs.

H. FGBC Commercial Standard Version 3 1.0: The intent of the FGBC Green Commercial Building Standard is to encourage building owners to adopt green and sustainable strategies during the design and construction of their project and to receive recognition for their efforts. The Florida Green Commercial Building Standard covers all commercial occupancies listed in the Florida Building Code.

I. Light Pollution: Light that extends beyond its source such that the additional light is wasted in an unwanted area or in an area where itinhibits view of the night sky

J. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock

K. Post-Consumer Recycled Content: The percentage by weight of constituent materials that have been recovered or otherwise diverted fromthe solid-waste stream after consumer use

L. Pre-Consumer Recycled Content: Materials that have been recovered orotherwise diverted from the solid-waste stream during the manufacturingprocess. Pre-consumer content must be material that would not have otherwise entered the waste stream as per Section 5 of the FTC Act, Part260 “Guidelines for the Use of Environmental Marketing Claims”: www.ftc.gov/bcp/grnrule/guides980427

M. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 700 miles (400 km) from the Project site

N. Salvaged or Reused Materials: Materials extracted from existing buildingsin order to be reused in other buildings without being manufactured

O. Sealant: Any material that fills and seals gaps between other materials

P. Type 1 Finishes: Materials and finishes which have a potential for short- term levels of off gassing from chemicals inherent in their manufacturing process, or which are applied in a form requiring vehicles or carriers for spreading which release a high level of particulate matter in the process ofinstallation and/or curing.

Q. Type 2 Finishes: “Fuzzy" materials and finishes which are woven, fibrous,or porous in nature and tend to adsorb chemicals offgassed by Type 1 finishes or may be adversely affected by particulates. These materials become "sinks" for deleterious substances which may be released much later, or collectors of contaminants that may promote subsequent bacterialgrowth.

R. Volatile Organic Compounds (VOCs): Any compound of carbon, excludingcarbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmosphericphotochemical reactions. Compounds that have negligible photochemical reactivity, listed in EPA 40 CFR 51.100(s), are also excluded from this regulatory definition.

1.5 SUBMITTALS

A. General: Additional Sustainable Design submittal requirements are included in other sections of the Specifications.

B. Sustainable Design Submittals:

1. Alternative Transportation: Provide manufacturer’s cut sheets for all bike racks installed on site, including the total number of bicycle storage slots provided. Also, provide manufacturer’s cut sheets forany alternative-fuel refueling stations installed on site, including fueling capacity information for an 8-hour period.

2. Heat Island Effect:

a. Site Paving: Provide manufacturer’s cut sheets for all impervious paving

materials, highlighting the Solar ReflectanceIndex (SRI) of the material. Also, provide cut sheets for all pervious paving materials.

b. Roofing Materials: Submittals for roofing materials must include manufacturer's cut sheets or product data highlighting the Solar Reflectance Index (SRI) of the material.

3. Exterior Lighting Fixtures: Submittals must include cut sheets with manufacturer's data that meet or exceed the efficiency requirements of the 2018 IECC Chapter 4 CommercialEnergy Efficiency for Exterior Lighting C405.4.2. Do not exceed the light levels and uniformity ratios recommended by the Illuminating Engineering Society of North America (IESNA) Recommended Practice Manual: Lighting for Exterior Environments (RP-33-99). Design exterior lighting such that all exterior luminaires with more than 1000 initial lamp lumens are shielded and all luminaires with more than 3500 initial lamp lumens meet the Full Cutoff IESNA Classification. If the bulb exceeds 26W the lights shall be full cut off luminaires so that no light or brightness from those luminaires crosses the property boundary. All fixtures selected need to provide a minimum of 95 lumens/watt.

4. Interior Lighting Fixtures: Submittals must include cut sheets of all interior lighting selections.

5. Irrigation Systems: Provide manufacturer's cut sheets for all permanent landscape irrigation system components and for any rainwater harvesting system components, such as cisterns.

6. Water Conserving Fixtures: Submittals must include manufacturer's cut sheets for all water-consuming plumbing fixtures and fittings (toilets, urinals, faucets, showerheads, etc.) highlighting maximum flow rates and/or flush rates. Include cut sheets.

7. Process Water Use: Provide manufacturer's cut sheets for all water- consuming commercial equipment (clothes washers, dishwashers, icemachines, etc.), highlighting water consumption performance. Includemanufacturer's cut sheets or product data for any cooling towers, highlighting water consumption estimates, water use reduction measures, and corrosion inhibitors.

8. Elimination of CFCs AND HCFCs: Provide manufacturer's cut sheets for all cooling equipment with manufacturer's product data, highlighting refrigerants.

9. Appliances and Equipment: Provide copies of manufacturer's product data for all Energy Star eligible equipment and appliances, includingoffice equipment, computers and printers, electronics, and commercial food service equipment (excluding HVAC and lighting components), verifying compliance with EPA's Energy Star program.

10. Measurement and Verification Systems: Provide cut sheets andmanufacturer's product data for all controls systems, highlighting electrical metering and trending capability components.

11. Salvaged or Reused Materials: Provide documentation that lists each salvaged or reused material, the source or vendor of the material, the purchase price, and the replacement cost if greater than the purchase price.

12. Recycled Content: Submittals for all materials with recycled content (excluding MEP systems equipment and components) must include the following documentation:

a. Cost of each material or product, excluding cost of labor and equipment for

installation

b. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product

c. The FGBC Commercial Checklist v3 Rev 1.0 Materials Worksheet needs to be used to track recycled materials (based on materials cost). Use materials with recycled content such that post-consumer and/or post-industrial recycled content constitutes a minimum of 5% of the total project cost. Earn one additional point for each additional 5% of recycled content materials. The value of the recycled content portion of a material or furnishing shall be determined by dividing the weight of recycled content in the item by the total weight of all material in the item, then multiplying the resulting percentage by the total value of the item. Mechanical and electrical components shall not be included in this calculation. Recycled content materials shall be defined in accordance with the Federal Trade Commission document, Guide for the Use of Environmental Marketing Claims, 15 CFR 260.7 (e), available at www.ftc.gov/bcp/grnrule/guides980427.htm.

13. Regional Materials: Submittals for all products or materials expected to contribute to the regional calculation (excluding MEP systems equipment and components) must include the following documentation:

a. Cost of each material or product, excluding cost of labor and equipment for installation

b. Location of product manufacture and distance from point ofmanufacture to the Project Site

c. Location of point of extraction, harvest, or recovery for each rawmaterial in each product and distance from the point of extraction, harvest, or recovery to the Project Site

d. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of manufacture for each regional material

e. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of extraction, harvest, or recovery for each regional material or product, including, at a minimum, gravel and fill, planting materials, concrete, masonry, and GWB

f. The FGBC Commericla Checklist v3 Rev 1.0 Materials Worksheet needs to be used to track raw materials that are harvested, extracted, or recovered within a 700-mile radius from project site.

14. Biobased Products:

a. Certified Wood: Submittals for all wood-based materials must include a statement indicating the cost of each product containing FSC Certified wood, exclusive of labor and delivery costs, and third-party verification of certification from one of the following:

1) Certificates of chain-of-custody from manufacturers certifying that specified certified wood products were made from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2 "Principles and Criteria." Letter

from approved Canadian Standards Association (CSA) supplier for verifying compliance with CSA Standard Z809-02 and Standard CSA Plus 1163.

2) Documentation from the supplier verifying that 100% of the wood-based content originates from SFI third-partycertified forest lands, identifying the company or companies that performed the SFI third-party certification for both the forest land management and the certified product content.

15. Outdoor Air Delivery Monitoring: Provide manufacturer's cut sheets highlighting the installed carbon dioxide monitoring system components and sequence of controls shop drawing documentation,including CO_2 differential set-points and alarm capabilities.

16. Interior Paints and Coatings: Submittals for all field-applied paints andcoatings, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content

17. Exterior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on ambient air quality, must include manufacturer's MSDSs or other manufacturer's ProductData highlighting VOC content.

18. Floor coverings:

    a. Carpet Systems: Submittals for all carpet must include thefollowing:

        1) Manufacturer's product data verifying that all carpetsystems meet or exceed the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.

    b. Resilient Flooring: Submittals for all resilient floorcovering must include manufacturer's product data verifying certification under either the UL GREENGUARD for Gold or FloorScore indoor emissions testing program.

    c. Engineered Wood Flooring and Bamboo Flooring: Submittals for all engineered wood flooring and bamboo flooring must include manufacturer's product data verifying certification under either the UL GREENGUARD or FloorScore indoor emissions testing program.

19. Composite Wood and Agrifiber Binders: Submittals for all composite wood and agrifiber products (including but not limited to particleboard,wheatboard, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products) must include manufacturer's product data verifying that these products contain no urea-formaldehyde resins.

20. Entryway Systems: Provide manufacturer's cut sheets for all walk-off systems installed to capture particulates, including permanently installed grates, grilles, slotted systems, direct glue-down walk-off mats, and non-permanent roll-out mats.

21. Air Filtration: Provide manufacturer's cut sheets and product data highlighting the following:

    a. Minimum Efficiency Reporting Value (MERV) for filtration mediain all air handling units (AHUs)

    b. Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction

22. Mercury in Lighting: Provide manufacturer's cut sheets or product data for all

fluorescent or HID lamps highlighting mercury content.

23. Lighting Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all lighting controls systems components.

24. Blended Cement: It is the intent of this specification to reduce CO_2 emissions and other environmentally detrimental effects resulting from the production of portland cement by requiring that all concrete mixes, in aggregate, utilize blended cement mixes to displace 40% of the portland cement typically included in conventional construction. Provide the following submittals:

    a. Copies of concrete design mixes for all installed concrete

    b. Copies of typical regional baseline concrete design mixes for all compressive strengths used on the Project

    c. Quantities in cubic yards of each installed concrete mix

25. All insulation products contain no urea- formaldehyde.

C. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials used for the Project, as follows:

1. Not more than 60 days after the Preconstruction Meeting, the Construction Manager shall provide to the City and Architect a preliminary schedule of materials costs for all materials used for the Project organized by specification section. Exclude labor costs and all mechanical, electrical, and plumbing (MEP) systems materials andlabor costs. Include the following:

    a. Identify each reused or salvaged material, its cost, and its replacement value.

    b. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product's weight, its cost, its combined recycled content value (defined asthe sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value), and the total combined recycled content value for all materials as a percentage of total materials costs.

    c. Identify each regional material, its cost, its manufacturing location, the distance of this location from the Project site, the source location for each raw material component of the material,the distance of these extraction locations from the Project site, and the total value of regional materials as a percentage of totalmaterials costs.

    d. Identify each biobased material, its source, its cost, and the total value of biobased materials as a percentage of total materials costs. Also provide the total value of rapidly renewable materials(materials made from plants that are harvested in less than a
    10-year cycle) as a percentage of total materials costs.

    e. Identify each wood-based material, its cost, the total wood- based materials cost, each FSC Certified wood material, its cost, and the total value of FSC Certified wood as a percentageof total wood-based materials costs.

2. Provide final versions of the above spreadsheets to the City and Architect not more than 14 days after Substantial Completion.

D. Construction Waste Management: A construction waste management plan is to be provided by the Construction Manager for review within 20 days of notice to proceed

and must be in accordance with FGBC 3.1 Commercial rating system. A sample waste report from the hauler must be submitted prior to hiring to be sure recycling rates are tracked correctly. Provide monthly waste reports from the haulers to the sustainablility consultants so that recycling rates can be tracked.

E. Construction Indoor Air Quality (IAQ) Management: Submittals must include the following:

1. Not more than 30 days after the Preconstruction Meeting, prepare and submit for the Architect and City's approval, an electronic copy of the draft Construction IAQ Management Plan in an electronic file including, but not limited to, descriptions of the following:

   a. Construction procedures for meeting or exceeding the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling Construction procedures for protecting absorptive materialsstored on-site or installed from moisture damage

   b. Schedule of submission to Architect of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored or installed absorptive materials

   c. Construction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille

   d. Construction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction,including a description of filtration media to be used at each air handling or air supply unit

2. Not more than 30 days following receipt of the approved draft CIAQMP, submit an electronic copy of the approved CIAQMP in an electronic file, along with the following:

   a. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for all filtration media to be installed at return air grilles during construction if permanently installed AHUs are used during construction.

   b. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration mediain all air handling units (AHUs).

3. Not more than 14 days after Substantial Completion provide the following:

   a. Documentation verifying required replacement of air filtration media in all air handling units (AHUs) after the completion of construction and prior to occupancy and, if applicable, requiredinstallation of filtration during construction.

   b. Weekly photographs taken during construction of the SMACNA approaches employed, along with a brief description of each approach, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.

F. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports for the following:

1. Construction Waste Management: Waste reduction progress reports must be submitted monthly.
2. Construction IAQ Management: See details below under Section 3.2 Construction Indoor Air Quality Management for Construction IAQ management progress report requirements.

1.6 QUALITY ASSURANCE

A. General: Perform the work of this Section as a supplement and in accordance with applicable requirements of Division 1 “Contractor Quality Control Program.”

B. Preconstruction Meeting: After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with City,Architect, and all Subcontractors to discuss the Construction Waste Management Plan, the required Construction Indoor Air Quality (IAQ) Management Plan, and all other Sustainable Design Requirements. The purpose of this meeting is to develop a mutual understanding of the Project’s Sustainable Design Requirements and coordination of the Construction Manager’s management of these requirements with the Contracting Officer and the Construction Quality Manager.

C. Construction Job Conferences: The status of compliance with the Sustainable Design Requirements of these specifications will be an agenda item at all regular job meetings conducted during the course of work at the site.

PART 2 - PRODUCTS

2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS

A. Site Clearing: Topsoil shall be provided by the Construction Manager from on-site material which has been stockpiled for reuse. Off-site borrow should only be used when on-site sources are exhausted. Chip and/or compost on siteall vegetated material identified for removal. Do not burn rubbish, organic matter, etc. or any material on the site. Dispose of legally in accordance with Specifications Sections 01 52 40.

B. Site Paving: All site impervious paving must be light colored, with a SolarReflectance Index (SRI) of at least 35.

C. Roofing Materials: All roofing systems, other than vegetated roof systems, must comply with the following requirements:

1. The roof materials must be energy star or have an SRI greater than or equal to 78.

D. Exterior Lighting Fixtures:

1. Do not exceed the light levels and uniformity ratios recommended by the Illuminating Engineering Society of North America (IESNA) Recommended Practice Manual: Lighting for Exterior Environments (RP-33-99). Design exterior lighting such that all exterior luminaires with more than 1000 initial lamp lumens are shielded and all luminaires with more than 3500 initial lamp lumens meet the Full Cutoff IESNA Classification. If the bulb exceeds 26W the lights shall be full cut off luminaires so that no light or brightness from those luminaires crosses the property boundary.

2. Exterior lighting fixtures selected must provide a minimum of 95 lumens/watt.

3. Meet or exceed the efficiency requirements of the 2018 IECC Chapter 4 Commercial Energy Efficiency for Exterior Lighting C405.4.2.

E. Water-Conserving Fixtures/equipment: Plumbing fixtures and fittings shall use in aggregate at least 40% less water than the water use baseline calculatedfor the building after meeting the Energy Policy Act of 1992 fixture performance requirements. Flow and flush rates shall not exceed the following:

1. Toilets: no more than 1.1 gallons per flush

2. Urinals: no more than 0.125 gallons per flush or use

3. Lavatory Faucets: 0.5 gpm with automatic faucet controls

4. Kitchen Faucets: 2.2 gpm

5. Showerheads: 1.75 gpm

6. Dishwashers: all dishwashers must be Energy Star Qualified with Water Factor (WF $\leq$ 7.0)

F. Elimination of CFCs AND HCFCs:

1. Ozone Protection: Requires that all building HVAC&R systems be free of CFC's and Halons.

2. Fire suppression systems may not contain ozone-depletingsubstances.

3. Extruded polystyrene insulation (XPS) and closed-cell spray foampolyurethane insulation shall not be manufactured with hydrochlorofluorocarbon (HCFC) blowing agents.

G. Salvaged or Reused materials: There shall be no substitutions for specified salvaged and reused materials and products.

H. Recycled Content of Materials:

1. Provide building materials with recycled content such that post- consumer recycled content value plus half the pre-consumer recycledcontent value constitutes a minimum of 5% of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and delivery costs. The Construction Manager shall make all attempts to maximize the procurement of materials with recycled content.

a. The post-consumer recycled content value of a material shall be determined by dividing the weight of post-consumer recycled content by the total weight of the material and multiplying by the cost of the material.

b. The pre-consumer recycled content value of a material shall be determined by dividing the weight of pre-consumer recycled content by the total weight of the material and multiplying by the cost of the material.

c. Do not include mechanical and electrical components in the calculations.

d. Do not include labor and delivery costs in the calculations.

e. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing

Claims," 16 CFR 260.7 (e).

f. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value.

g. At a minimum, the materials in the following list must contain the minimum recycled content indicated:

l. Local/regional Materials: A minimum of 5% (by cost) of the project materials that are manufactured, extracted or recovered within a 700-mile radius of the project site, exclusive of labor and delivery costs. The Construction Manager shall make all attempts to maximize the procurement of materials within this specified 700-mile radius.

Biobased Products:

1. Solid Wood Products: All new solid-wood-based materials will be certified as "FSC 100%" by an independent third party in accordance with FSC Forest Stewardship Council "Principles and Criteria" and willhave received Chain-of-Custody Certification as certified by an accredited certification group such as Smartwood or Scientific Certification Systems (SCS).

2. Other Wood Products: All other new wood-based materials will be certified by an independent third party in accordance with any of thefollowing standards:

   a. FSC: Forest Stewardship Council "Principles and Criteria" andhas received Chain-of-Custody Certification as certified by an accredited certification group such as Smartwood or ScientificCertification Systems (SCS)

   b. CSA: Canadian Standards Association Standard Z809-02 andStandard CSA Plus 1163 (chain of custody standard) administered by CSA International.

   c. SFI: Sustainable Forestry Initiative third-party certification verifying that 100% of the wood-based content originates from third-party certified forest lands. Note that the appearance of anSFI label on a product does NOT ensure such certification; rather, such certification must come with separate documentation from the supplier, identifying the company or companies that performed the third-party certification for both the forest land management and the certified product content.

3. Preservative-treated lumber with chromated copper arsenate (CCA) treatments is not permitted, and lumber with copper-based treatments(such as ACQ) is permitted only for ground-contact applications. Wood-based materials include but are not limited to the following materials (when made from wood), engineered wood products, orwood-based panel products:

   a. Rough carpentry

   b. Miscellaneous carpentry

   c. Heavy timber construction

   d. Wood decking

   e. Particleboard

f. Plywood

g. Metal-plate-connected wood trusses

h. Structural glued-laminated timber

i. Finish carpentry

j. Architectural woodwork

k. Wood paneling

l. Wood veneer wall covering

m. Wood flooring

n. Wood lockers

o. Wood cabinets

p. Wood doors

q. Non-rented temporary construction, including bracing, concreteformwork, pedestrian barriers, and temporary protection

J. Brominated Flame Retardants: For new furniture, do not utilize cushioned office seating, and for lounge seating, do not utilize cushioned seating with brominated flame retardants.

K. Outdoor Air Delivery Monitoring:

1. All Systems shall be designed to monitor carbon dioxide (CO2) within the building and activate an audible alarm w/ corrective action plan such that mechanical air conditioning system can introduce treated fresh air as needed.

L. Paints and Coatings:

a. Interior and Exterior Paints and Coatings: Paints and coatings shall have VOC less than or equal to the values listed below:

Interior Coating Gram / Liter

- Non-Flat 150
- Flat 50

Exterior Coating Gram / Liter

- Non-Flat 200
- Flat 100

2. Interior field applied varnishes and lacquers are not permitted.

3. Interior paints shall not contain antimicrobial additives (such as fungicides and biocides).

4. Aromatic Compounds: Paints and coatings shall not contain morethan 1% (by weight) total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

5. Coordinate with paint manufacturers for implementing a “take-back program” for all unused paint. Set aside scrap and unused paint to bereturned to the

manufacturer for recycling into new product. Close and seal all partially used containers of paint to maintain quality as necessary for reuse.

M. Floorcoverings:

1. All carpet systems, including adhesives, must meet or exceed the Carpet and Rug Institute Green Label Plus Indoor Air Quality Test Program.

2. All resilient floorcovering must be certified under the UL Greenguard FloorScore indoor emissions testing programs.

3. Engineered wood flooring and bamboo flooring must be certified under the UL GREENGUARD or FloorScore indoor emissions testing programs.

N. Composite Wood and Agrifiber Binders: All composite wood, agrifiber products, and wood doors shall contain no added urea-formaldehyde resins.

O. Entryway Systems: Walk-off systems to capture particulates shall be installed at least 12 feet long in the direction of entry travel at all entrywaysdirectly connected to the outdoors that are used as regular entry points bybuilding users. Acceptable entryway systems include:

1. Permanently installed grates, grilles, or slotted systems that allow forcleaning beneath them

2. Permanently installed direct glue-down walk-off mats

3. Non-permanent roll-out mats, but only if a service organization iscontracted for maintenance on a weekly basis

P. Air Filtration: Install air filtration media that provides a Minimum Efficiency Reporting Value (MERV) of 13 or better in all air handling units for processing both return and outside air that is delivered to the air supply system. Replace all filtration media after the completion of construction and prior to occupancy.

R. Gypsum Wallboard: Standard paper-faced gypsum wallboard can be used only in dry climates, where wetting during or after construction is not anticipated. In humid climates, where dampness and condensation are a concern, use only non-paper-faced gypsum wallboard. In wet locations a cementitious wallboard, made of portland or magnesium oxide cement, must be used.

S. Insulation: All insulation products will be free of formaldehyde.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

A. Develop and implement a Construction Waste Management Plan (CWMP) quantifying material diversion by weight in order to recycle, reuse, and/or salvage at least 95% (by weight) of construction, demolition, and land- clearing waste.

B. Clean materials which are contaminated prior to placing in collection containers. Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other

substances deleterious to the recycling process.

C. Utilize any on-site existing paving materials that are scheduled for demolition as granulated fill or subbase material, and include the weight of this material in the calculations for material diverted from landfill disposal.

D. Arrange for materials collection by or materials delivery to the appropriate recycling or reuse facility.

E. Tax credits and other savings obtained, or revenue generated for recycledor reused materials accrue to the Construction Manager.

F. Discuss CWMP procedures and measures as an agenda item at all regular job meetings conducted during the course of work at the site, andrecord progress in meeting minutes.

G. Submit monthly progress reports monthly with Applications for Payment, documenting the status of the CWMP and current diversion percentage rates.

3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Develop and implement a Construction IAQ Management Plan (CIAQMP) to prevent indoor air quality problems resulting from construction activities,including, at minimum, the following:

1. Construction activities must meet or exceed the minimum requirements of the SMACNA IAQ Guideline for Occupied Buildings under Construction, latest edition.

2. During construction, protect all absorptive materials stored on-site or installed from moisture damage as described in the Construction IAQ Management Plan (CIAQMP) defined above. Specifically:

   a. Exercise special care at all times in the storage of materials toprevent exposure to moisture.

   b. Avoid installation of gypsum wallboard and other porousmaterials until the building is weather-tight.

   c. All standing water which accumulates on interior floors shall beremoved on the day that it is observed.

   d. Any drywall that has retained more than 20% moisture after 48 hours following exposure to moisture, or that has evidence of mold, must be disposed of in accordance with Specification Section 01 52 40 “Construction Waste Management.”

   e. The Construction Manager shall identify and remove all porous building materials that become wet or damaged by moisture within 7calendar days of such exposure.

3. During construction and HVAC system installation, provide the Architect with photographs of IAQ management measures (such asprotection of ducts and on-site or installed absorptive materials), including weekly photographs depicting implemented SMACNA approaches.

B. Air Filtration:

1. Install air filtration media that provides a Minimum Efficiency Reporting Value (MERV) of 13 or better in all air handling units for processing both return and outside air that is delivered to the air supply system; replace all filtration media after the completion of construction and prior to occupancy.

2. Install air filtration media that provides a Minimum Efficiency ReportingValue (MERV) of 8 or better for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction. Inspect weekly and replace as required.

C. Discuss CIAQMP procedures and measures as an agenda item at all regular job meetings conducted during the course of work at the site, and record progress in meeting minutes.

FLORIDA GREEN BUILDING COALITION 'FGBC'

This Project is seeking certification with the Florida Green Building Coalition ("FGBC") and is pursuing, at a minimum, a Silver level certification under FGBC's Commercial Building Standard Version 3/Revision 1, being referred to hereinafter as the ("Project Certification"). FGBC Certification is a requirement of the City of Delray Beach, for compliance with Land Development Regulations Ordinance No. 30-22, Green Building.

The Construction Manager/General Contractor, its Agents, Specialty Contractors and Vendors shall make themselves familiar with the FGBC Commercial Rating System Version 3/Revision 1. Details of the program requirements can be found in the Commercial Reference Guide located at http://floridagreenbuilding.org/commercial.

Adhering to the FGBC Commercial Certification Standard is required for the Project to achieve the Project Certification. The FGBC Design and Construction Requirements shall therefore be strictly complied with by the Construction Manager/General Contractor, its Agents, its Subcontractors and Vendors (collectively, the "Construction Manager/General Contractor Team") at all times during the Work.

Any deviation or noncompliance with the FGBC Design and Construction Requirements by the Construction Manager/General Contractor Team may prevent or delay the Project from achieving the Project Certification.

FGBC Definitions and Acronyms

Credit Points – Qualification points assigned to features that improve the environmental, ecological and sustainability impacts of a building.

Florida Green Building Coalition – A Florida non-profit corporation with open membership whose primary mission is to develop and maintain Green Designation Standards for Florida and to promote cost-effective, sustainable improvements in the built environment.

Green Commercial Building - A commercial building that incorporates multiple environmental, ecological and sustainability features that reduce the environmental degradation throughout its life cycle considerably more than a commercial building that just minimally meets state and local regulations.

Designated Professional – An individual who is authorized by the project owner to coordinate project information with the FGBC Project Evaluator and who shall collect, organize, review, and submit all documents required by the Standard in order to achieve certification.

Project Evaluator - An individual assigned by the Florida Green Building Coalition to evaluate a commercial building with respect to the criteria contained in this Standard for the purposes of certifying that the qualifications for a Florida Green Commercial Building.

Official Documents

The official documents of the Florida Green Building Commercial Building Standard are available to the public as downloadable electronic files from the Florida Green Building Coalition website, and include:

A. The "Checklist" shall assign Credit Points for green criteria of this Standard and shall be the official application for certification.
B. The "Reference Guide" provides information on green building practices, details on how to earn points for complying with the Commercial Standard, and required submittal documentation for Credit Points.
C. The "Standards and Policies" document describes the policies of the Florida Green Commercial Building Designation Standard.
D. The "Modification Request Form" shall allow for submission of proposed changes to the Standard.

FGBC Commercial Building Certification Standard Version 3/Revision 1.

The Construction Manager/General Contractor Team hereby acknowledge and agrees to strictly comply, cooperate with and assist the A/E Professional and/or Owners Representative, City, and FGBC Designated Professional, when applicable, with satisfying the following FGBC Commercial Building Certification Standard prerequisites, credits and points, each being part of the FGBC Design and Construction Requirements:

The following categories and credits represent the entirety of the standard. Refer to updated checklists and communication(s) from the Construction Manager/General Contractor team, City and Designated Professional.

Refer to the most current Checklist, FGBC Florida Commercial Building Certification Standard Reference Guide Version 3 Revision 1 Standards. Notify the Designated Professional and Commissioning Agent, as applicable, for detailed information on requirements, intent, strategies and compliance details, referenced in the outline below.

Note that items listed as 'Prerequisites' are mandatory and must be achieved, at a minimum, to be considered for FGBC Certification. Minimums are also required in every Category listed below. Many of these items have been incorporated into the design and shall be strictly adhered to during the construction phase to ensure compliance.

The following prerequisites must be complied with, at a minimum, as part of the overall requirements to achieve a Silver level (or higher) green building certification. See prerequisite summary below.
Reference the Florida Green Commercial Reference Guide Version 3 Revision 1 (or current version at time of project registration) for details on all prerequisites, program requirements and credits.

FGBC PREREQUISITE SUMMARY

Project Management
PM Prerequisite 1: Green Project Meeting

Energy
E Prerequisite 1: City Project Requirements (OPR)
E Prerequisite 2: Basis of Design (BOD)

E Prerequisite 3: Testing and Balancing of Installed Equipment
E Prerequisite 4: Minimum Energy Performance
E Prerequisite 5: CFC Reduction in HVAC Equipment

Water
W Prerequisite 1 No Invasive Plants
W Prerequisite 2 Irrigation zones for turf and landscape beds are separate
W Prerequisite 3 Rain shut off device installed CORRECTLY and operable
W Prerequisite 4 Drought Tolerant Landscape, 25%

Site
S Prerequisite 1: Stormwater Pollution Prevention Plan (SWPPP) and Florida Department of Environmental Protection (FDEP) Notice of Intent (NOI) onsite

Health
H Prerequisite 1: Environmental Tobacco Smoke (ETS) Control
H Prerequisite 2: Indoor Air Quality (IAQ) Management Plan, During Construction

Materials
M Prerequisite 1: Storage & Collection of Recyclables

Disaster Mitigation
None

Environmental Innovation
None

A percentage of the following credits, beyond the prerequisites, must be pursued, per the project goals and City criteria to achieve a Silver level (or higher) green building certification. Reference the Florida Green Commercial Reference Guide Version 3 Revision 1 (or current version at time of project registration) for details on all requirements and credits.

Category 1 Project Management
PM1 Building Information Modeling
PM2 Cost Benefit Analysis
PM3 Green Education

Category 2 Energy
E1 EPA Target Finder
E2 Portfolio Manager
E3 Commissioning
- E3.01 Commissioning: Fundamental
- E3.02 Commissioning: Enhanced
- E3.03 Commissioning: Building Envelope

E4 Energy Performance Improvement
E5 Renewable Energy Production
E6 Green Power
E7 Daylight Sensors
E8 Occupancy Sensors
E9 Interior Lighting

E10 Lighting Power Density
E11 Exterior Lighting Efficiency
E12 Solar Study of Building
E13 Energy Monitoring Interface

Category 3 Water

W1 Interior Water Use
- W1.01 Toilets
- W1.02 Urinals
- W1.03 Lavatory Faucets
- W1.04 Kitchen Faucets
- W1.05 Showerheads
- W1.06 Dishwashers

W2 Greywater Use
- W2.01 Air conditioner condensate use
- W2.02 Greywater System - dual piping system

W3 Rainwater Harvesting

W4 Installed Landscape
- W4.01 100% Drought tolerant
- W4.02 < 30% Sod
- W4.03 No Installed Irrigation
- W4.04 Plants compatibility
- W4.05 Plants with similar maintenance grouped together
- W4.06 Non-Cypress Mulch

W5 Water Conservation Certifications
- W5.01 Meet or exceed Florida WaterStar ™ or WaterSense Standards
- W5.02 Florida Friendly

W6 Installed Irrigation

Category 4 Site

S1 FDEP Professional

S2 Site Selection
- S2.01 Select Appropriate Site
- S2.02 Urban Growth Boundary
- S2.03 Permit Ready Site
- S2.04 Greyfield/Redevelopment of an existing site
- S2.06 Access to Public Transportation
- S2.07 Adjacent to dense residential development
- S2.08 Access to Basic Services

S3 Site Enhancement
- S3.01 Wetand Protection and Enhancement
- S3.02 Minimize Site Disturbance
- S3.03 Site Open Space
- S3.04 Sidewalks
- S3.05 Connectivity

S4 Reduce Heat Islands – Hardscape
- S4.01 Minimize Provided Parking
- S4.02 Under Building Parking
- S4.03 Shaded, Covered or High Albedo Hardscape
- S4.04 Alternative Fuel Vehicles

S5 Reduce Heat Islands – Roof

S6 Reduce Heat Islands – Building

S7 Stormwater
- S7.01 Less than 10 acres, less than 2 acres of impact (<10<2)

S7.02 Standard General
S7.03 Treat Stormwater from adjacent sites
S7.04 Littoral Vegetation of Manmade Stormwater Detention
S7.05 Pervious Hardscape
S7.06 Alternative Stormwater Detention

S8 Vehicular Transportation Alternatives
S8.01 Bicycle Storage
S8.02 Changing Rooms
S8.03 Showering Facility

S9 Exterior Lighting (not attached to building)
S9.01 Meets Dark Sky Requirements
S9.02 > 95 lumens/watt
S9.03 Solar powered
S9.04 Timers or daylight sensors

Category 5 Health

H1 Protect, Monitor & Remediate Poor IAQ
H1.01 Carbon Dioxide
H1.02 Humidity Monitoring & Control
H1.03 Outdoor Pollutants
H1.04 Covered Entry
H1.05 High Efficiency Filtration
H1.06 Chemical and Cleaning Product Storage
H1.07 Radon mitigation (if applicable)
H1.08 Pre-Occupancy IAQ Testing

H2 Low Emitting Materials
H2.01 Adhesives and Sealants
H2.02 Paints & Coatings
H2.03 Carpet Systems
H2.04 Healthy Flooring
H2.05 Composite Wood & Agrifiber
H2.06 Insulation
H2.07 Green Cleaning

H3 System Controls
H3.01 Lighting
H3.02 Thermal Comfort

H4 Productive Work Environment
H4.01 Daylighting
H4.02 Acoustics
H4.03 Views
H4.04 Outdoor Space Provided for Employees

Category 6 Materials

M1 Material Efficiency and Global Responsibility
M1.02 Recycled Content
M1.03 Rapidly Renewable
M1.04 Certified Wood
M1.05 Biobased

M2 Waste Management
M2.01 Construction Waste Recycling
M2.02 Leased Floor Coverings
M2.03 Recyclable Materials
M2.04 Demountable/Adaptable Interiors
M2.05 Durable Materials, Exterior Finish Materials

M2.06 Low Maintenance Finishes
M3 Local/Regional Materials
M3.01 Local Manufacturing
M3.02 Local Raw Materials Extraction
M3.03 Resource Reuse

Category 7 Disaster Mitigation
DM1 Hurricane Resistance
DM1.01 Impact Glazing
DM1.02 Building Integrated Hurricane Shutters
DM1.03 Building Hardening
DM1.04 Uninterrupted Operations
DM1.05 Building Designated Hurricane Shelter
DM2 Pest Management
DM2.01 Termite Prevention
DM2.02 Physical Termite Barrier
DM2.03 Integrated Pest Management
DM3 Flood
DM2.01 Termite Prevention
DM2.02 Physical Termite Barrier
DM3.01 Finished Floor Elevation
DM3.02 Mechanical Equipment Pads
DM4 Fire Resistant Exterior Finishes

Category 8 Environmental Innovation
TBD-up to five points

END OF SECTION

SECTION 018150 - COMMISSIONING AUTHORITY RESPONSIBILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section covers the Commissioning Authority's responsibilities for commissioning:

1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists are utilized to achieve this.

2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests performed by Construction Manager and witnessed by the Commissioning Authority are utilized to achieve this.

B. Coordinate and direct all the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

C. The scope of commissioning activities is defined in Section 018100 - Commissioning.

D. Construction Manager's responsibilities are defined in Section 018100 - Commissioning.

1.2 SUBMITTALS

A. Commissioning Plan:

1. Submit preliminary draft for review by City and A/E Professional and/or Owners Representative after commencement of Commissioning Authority contract.

2. Submit revised draft to be included in the construction contract documents

3. Submit final plan not more than 90 days after commencement of construction, for issuance to all parties.

B. List of Prefunctional Checklists to be developed:

1. Submit final list not more than 60 days after start of construction.

C. Prefunctional Checklists:

1. Submit final draft to Construction Manager not less than 4 weeks prior to startup of particular items to be commissioned.

D. Functional Test Procedures:

1. Submit final draft to Construction Manager not less than 4 weeks prior to startup of particular items to be commissioned.

E. Final Commissioning Report: Submit to City and FGBC Consultant. PRODUCTS - Not applicable

PART 2 - EXECUTION

2.1 COMMISSIONING PLAN

A. Prepare and maintain the Commissioning Plan, covering commissioning schedule, Prefunctional Checklist and Functional Test procedures, coordination requirements, and forms to be used, for all parties in the commissioning process.

1. Call and chair meetings of the Commissioning Team when appropriate.

2. Give Construction Manager sufficient notice for scheduling commissioning activities.

3. Develop a comprehensive start-up and initial systems checkout plan with cooperation of Construction Manager and sub Construction Manager.

4. The PECI Model Commissioning Plan may be used as a guide for the Commissioning Plan.

5. ASHRAE Guideline 1 may be used as a guide for the Commissioning Plan.

6. Avoid replication of information included in the construction contract documents to the greatest extent possible.

B. Basis of Design Documentation: Detailed documentation of the functional requirements of the project; descriptions of the systems, components, and methods chosen to meet the design intent; assumptions underlying the design intent.

1. Prepared By: A/E Professional and/or Owners Representative.

2. Copy to be furnished to Commissioning Authority for use in preparation of the commissioning plan.

C. Review the construction contract documents for Construction Manager submittals of draft checklists, draft test procedures, manufacturer startup procedures, and other information intended for the use of the Commissioning Authority in preparing the Commissioning Plan.

D. Commissioning Schedule:

1. Coordinate with Construction Manager anticipated dates of startup of each item of equipment and system.

2. Construction Manager's scheduling responsibilities are specified in the construction contract documents.

3. Revise and re-issue schedule monthly.

4. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.

5. Deliver relevant Prefunctional Checklists and Functional Test Procedures to Construction Manager in time to avoid delay.

E. Commissioning Team: Project manager or another designated person of:

1. City's building or plant operation staff.

2. Commissioning Authority.

3. Design professional's A/E Professional and/or Owners Representative.

4. Construction Manager.

5. HVAC sub-Contractor.

6. HVAC control system sub-Contractor.

7. HVAC testing, adjusting, and balancing (TAB) sub-Contractor.

8. Electrical sub-Contractor.

9. Plumbing sub-Contractor.

10. Communications sub-Contractor.

11. Other sub-Contractors who will be required to perform commissioning activities.

2.2 CONSTRUCTION CONTRACT DOCUMENTS

A. General Commissioning Specifications: A/E Professional and/or Owners Representative will prepare general commissioning specifications for inclusion in the construction contract documents; review and submit comments to City.

2.3 PREFUNCTIONAL CHECKLISTS

A. Prefunctional Checklists - Content: Review Construction Manager's Startup Checklists in sufficient detail to document that the work has been installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup.

2.4 FUNCTIONAL TEST PROCEDURES

A. Develop test procedures in sufficient detail to show that functional performance is in accordance with the Contract Documents and shows proper operation through all modes of operation where there is a different system response, including seasonal, unoccupied, warm-up, cool-down, part- and full-load.

B. Functional Test Report Forms: Prepare forms in advance of testing, using a consistent format; include all test procedure information given to Construction Manager and:

2.5 CONSTRUCTION PHASE

A. Coordinate the commissioning work with Construction Manager, ensure that commissioning activities are being incorporated into the master schedule.

B. Perform site visits, as necessary, to observe component and system installations. Attend planning and job-site meetings to obtain information on construction progress. Review Construction Manager's meeting minutes for issues relating to the commissioning process. Assist in resolving discrepancies.

C. Commissioning Kick-Off Meeting: Plan and conduct a meeting early in the construction phase to review commissioning activities and responsibilities with all parties involved. Require attendance by all members of the Commissioning Team.

D. Conduct periodic meetings as necessary to coordinate, resolve planning issues, and aid in resolution of deficiencies, minimizing the time spent by Construction Manager and City personnel; hold meetings at least monthly.

E. Submit periodic progress reports to City and Construction Manager.

F. Review Construction Manager shop drawing submittals applicable to systems being commissioned for compliance with commissioning needs; verify that City's responsibilities are clearly defined in warranties.

G. Review and approve submittals directly related to commissioning.

H. Deliver Functional Test procedures to Construction Manager.

I. Verify satisfactory completion of Pre functional Checklists by Construction Manager by reviewing checklists and by site observation and spot checking; provide formal approval when satisfactory.

J. Verify startup of all systems by reviewing start-up reports and by site observation; provide formal approval when satisfactory.

K. Coordinate, witness and approve Functional Tests performed by Construction Manager. Coordinate retesting until satisfactory performance is achieved.

L. HVAC Commissioning:

1. Gather and review the control sequences and interlocks and work with Construction Manager and design engineers until sufficient clarity has been obtained, in writing, to be able to prepare detailed Functional Test procedures.
2. Witness all or part of duct testing and cleaning procedures, sufficient to be confident that proper procedures were followed.
3. Review T&B Plan prepared by Construction Manager.
4. Before T&B is executed, witness sufficient Functional Testing of the control system to approve it to be used for T&B.
5. Verify air balancing by spot testing, by reviewing completed reports, and by site observation; provide formal approval when satisfactory.

M. Witness and document testing of systems and components over which the Commissioning Authority does not have direct control, such as smoke control, exhaust systems, tests contracted directly by Construction Manager, and tests by manufacturer's personnel; include documentation in O&M manuals.

N. Perform Functional Testing for systems and equipment so specified, without assistance of Construction Manager.

O. Maintain a master deficiency and resolution log and a separate testing record. Provide written progress and test reports with recommended actions.

P. Notify Construction Manager and City of deficiencies in procedures or results; suggest solutions.

2.6 CLOSEOUT

A. Commissioning

1. Include the Final Commissioning Plan and Final Report.
2. For each product or system and equipment item, include the following organized as indicated, with separator tabs:
    a. Design intent documentation furnished by A/E Professional and/or Owners Representative or others.
    b. Detailed operational sequences.
    c. Startup plan and approved startup reports.
    d. Filled out Prefunctional Checklists.
    e. Filled out Functional Test reports; trend logs and monitoring reports and analysis; other verification documentation.

B. Final Commissioning Report: Include:

1. Executive summary.
2. List of participants and roles.
3. Brief facility description.
4. Overview of commissioning scope and general description of testing and verification methods.
5. For each item commissioned, an evaluation of adequacy of:
    a. The product itself, i.e. compliance with the contract documents.
    b. Installation.

c. Functional performance: include a brief description of the verification method used and observations and conclusions from the testing.

6. List of all outstanding non-compliance items, referenced to the specific functional test, inspection, trend log, etc., where the deficiency is documented.
7. List of unresolved issues, seasonal or deferred testing, and other concerns that could affect facility operation.
8. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. (about four to six pages).
9. Attach appendices containing all commissioning documentation, including logs, minutes, reports, deficiency lists, communications, findings, etc., except that specified to be part of the Commissioning Record.

END OF SECTION

SECTION 018200 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing City'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.

3. Training in care, cleaning, maintenance and repair.

4. Demonstration and training videotapes.

B. Related Sections include the following:

1. Divisions 2 through 48 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 SUBMITTALS

A. Attendance Record: For each training module, submit list of participants and length of instruction time.

B. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

C. See Section 013300 – Submittal Procedures, for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.

2. Submit one copy to the Commissioning Authority, not to be returned.

3. Make commissioning submittals on time schedule specified by Commissioning Authority.

4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2010 or later preferred.

D. Demonstration and Training Videos: Submit five (5) copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.

b. Name and address of photographer.

c. Name of A/E Professional and/or Owners Representative.

d. Name of Construction Manager.

e. Date videotape was recorded.

f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

E. Training Plan: City will designate personnel to be trained; tailor training to needs and skill-level of attendees.

1. Submit to A/E Professional and/or Owners Representative for transmittal to City.
2. Submit not less than four weeks prior to start of training.
3. Revise and resubmit until acceptable.
4. Provide an overall schedule showing all training sessions.
5. Include at least the following for each training session:
    a. Identification, date, time, and duration.
    b. Description of products and/or systems to be covered.
    c. Name of firm and person conducting training; include qualifications.
    d. Intended audience, such as job description.
    e. Objectives of training and suggested methods of ensuring adequate training.
    f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    g. Media to be used, such a slides, hand-outs, etc.
    h. Training equipment required, such as projector, projection screen, etc., to be provided by Construction Manager.

F. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.

1. Include applicable portion of O&M manuals.
2. Include copies of all hand-outs, slides, overheads, video presentations, etc. that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

1.5 COORDINATION

A. Coordinate instruction schedule with City's operations. Adjust schedule as required to minimize disrupting City's operations.

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 A/E Professional and/or Owners Representative.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices, chillers, cooling towers, energy recovery units, etc.
2. HVAC instrumentation and controls.
3. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls generator, transfer switch, etc.
4. Lighting equipment and controls.
5. Communication systems, including intercommunication, surveillance, clocks and programming voice and data, and television equipment.
6. Lightning detection and warning systems.

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:

1. 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.
2. 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.
3. 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.

4. Adjustments: Include the following:

a. Alignments.

b. Checking adjustments.

c. Noise and vibration adjustments.

d. Economy and efficiency adjustments.

5. Troubleshooting: Include the following:

a. Diagnostic instructions.

b. Test and inspection procedures.

6. 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.

7. 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 combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Construction Manager and City for number of participants, instruction times, and location.

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

1. Construction Manager will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.

2. City will furnish Construction Manager with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.

1. Schedule training with City with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written and a demonstration performance-based test.

E. Cleanup: Collect used and leftover educational materials and give to City. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION – GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by City.

B. Demonstrations conducted during Functional Testing need not be repeated unless City personnel training is specified.

C. Demonstration may be combined with City personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shutdown, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.4 TRAINING – GENERAL

A. Conduct training on-site unless otherwise indicated.

B. City will provide classroom and seating at no cost to Construction Manager.

C. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

D. Provide training in a minimum of two-hour segments.

E. Training schedule will be subject to availability of City's personnel to be trained; re-schedule training sessions as required by City; once schedule has been approved by City failure to conduct sessions according to schedule will be cause for City to charge Construction Manager for personnel "show-up" time.

F. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

1. The location of the O&M manuals and procedures for use and preservation; backup copies.

2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.

3. Typical uses of the O&M manuals.

G. Product- and System-Specific Training:

1. Review the applicable O&M manuals.

2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.

3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.

4. Provide hands-on training on all operational modes possible and preventive maintenance.

5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.

6. Discuss common troubleshooting problems and solutions.

7. Discuss any peculiarities of equipment installation or operation.

8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.

9. Review recommended tools and spare parts inventory suggestions of manufacturers.

10. Review spare parts and tools required to be furnished by Construction Manager.

11. Review spare parts suppliers and sources and procurement procedures.

H. Be prepared to answer questions raised by training attendees; if unable to answer during the training session, provide written response within three days.

3.5 DEMONSTRATION - TRAINING VIDEOS

A. General: Engage a qualified commercial photographer to record demonstration and training videotapes. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At the beginning of each training module, record each chart containing learning objective and lesson outline.

B. Videotape Format: Provide high-quality USB color video.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

END OF SECTION

SECTION 022200 – SITE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All applicable provisions of the Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the site demolition work as specified herein.

B. Site demolition includes but is not limited to demolition and removal of paver and concrete sidewalks, concrete curbs, asphalt pavement, handicap ramps, light poles and the associated electrical components, fences, tree grates and removal or relocation of existing trees.

C. Prior to any demolition activities a Stormwater Pollution Prevention Plan shall be required in accordance with the criteria of the Florida Department of Environmental Protection. Adequate silt containment procedures and equipment shall be used to control turbidity at all times. Erosion protection and earth stabilization are mandatory. All inlets and catch basins shall be protected from sediment contained in runoff.

1.3 RELATED WORK

A. All applicable sections of the Specifications.

B. Conditions of the Contract.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications: Minimum of five (5) years experience in demolition of comparable nature.

B. Meet requirements of all applicable Regulatory Agencies including compliance with all applicable Building Codes and other Public Agencies having jurisdiction upon the work.

1.5 SUBMITTALS

A. Permits and notices authorizing demolition.

B. Certificates of severance of utility services.

C. Permit for transport and disposal of debris.

D. Demolition procedures and operational sequence for review and acceptance by City of Delray Beach.

1.6 JOB CONDITIONS

A. Existing Conditions

1. The demolition work shall be done as indicated on the demolition plan.

2. Remove all demolition debris from the site the same day the work is performed. Leave no deposits of demolished material on site over night.

B. Protection:

1. Erect barriers, fences and shoring to protect personnel, structures, and utilities remaining intact.
2. Protect designated trees and plants from damages.

3. Use all means necessary to protect existing objects and vegetation designated to remain, and, in the event of damage, immediately make all repairs, replacements and dressings as necessary to the approval of the City of Delray Beach at no additional cost.

C. Maintaining Traffic:

1. Ensure minimum interference with roads, streets, driveways, sidewalks, and adjacent facilities.

2. Do not close or obstruct streets and sidewalks without written approval from the City of Delray Beach.

3. If required by governing authorities, provide alternate routes around closed or obstructed traffic ways.

D. Dust Control:

1. Use all means necessary for preventing dust from demolition operations from being a nuisance to adjacent property owners. Methods used for dust control are subject to the approval of the City of Delray Beach prior to use.

E. Burning:

1. On-site burning will not be permitted.

1.7 GENERAL ITEMS

A. Scope of work shall comprise the following: Provide all labor, materials, necessary equipment and services to complete the demolition and clearing work, as indicated on the contract plans, and as specified herein.

B. Be responsible for adherence to all applicable codes of all regulatory agencies having jurisdiction upon the works.

1.8 PRE-DEMOLITION MEETING

A. A meeting shall be held with the City of Delray Beach at the jobsite to describe intended demolition and cleaning procedures and schedules. This shall include identifying access routes for bringing necessary equipment in, removing debris from site, and designation of any trees, drives or other items to remain.

1.9 EXISTING CONDITIONS

A. Become thoroughly familiar with the site, and of existing utilities and their connections, and note all conditions which may influence the work. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

B. The City of Delray Beach shall be notified immediately should any hazardous materials be discovered during demolition.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that structures to be demolished are not in use and ready for removal.

B. Comply with all conditions and requirements of all applicable public agencies prior to commencement of the work.

3.2 PREPARATION

A. Arrange for and verify termination of utility services to include capping lines as necessary.

B. Notify the City of Delray Beach at least three (3) full working days prior to commencing the work of this Section.

3.3 CLARIFICATION

A. The drawings do not purport to show all objects existing on the site.

B. Before commencing the work of this Section, verify with the City of Delray Beach all objects to be removed and all objects to be preserved.

3.4 SCHEDULING

A. Schedule all work in a careful manner with all necessary consideration for the public and the City of Delray Beach.

B. Avoid interference with the use of, and passage to and from, adjacent facilities.

3.5 DISCONNECTION OF UTILITIES

A. Before starting site operations, disconnect or arrange for the disconnection of all affected utility service.

1. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Disconnect and stub off. Notify affected utility company in advance and obtain approval before starting this work.

2. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction.

3.6 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. Maintain existing utilities, keep in service, and protect against damage during demolition operations.

B. Prevent movement or settlement of adjacent structures. Provide and place bracing or shoring and be responsible for safety and support of structures. Assume liability for such movement, settlement, damage, or injury.

C. Cease operations and notify City of Delray Beach immediately if safety of adjacent structures appears to be endangered. Take precautions to properly support structures. Do not resume operations until safety is restored.

D. Prevent movement, settlement, damage, or collapse of adjacent services, sidewalks, driveways and trees. Assume liability for such movement, settlement, or collapse. Promptly repair damage at no cost to the City of Delray Beach.

E. Ensure safe passage of persons around areas of demolition.

3.7 MAINTAINING TRAFFIC

A. Do not interfere with use of adjacent buildings and facilities. Maintain free and safe passage to and from adjacent buildings and facilities. Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed travel ways if required by governing authorities.

3.8 POLLUTION CONTROLS

A. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations as directed by the City of Delray Beach or governing authorities. Return adjacent areas to condition existing prior to start of work.

3.9 INSPECTION AND PREPARATION

A. Verify that structures to be demolished are discontinued in use and ready for removal.

B. Do not commence work until all conditions and requirements of all applicable public agencies are complied with.

C. Arrange for and verify termination of utility services to include capping lines.

D. The drawings do not purport to show all objects existing on the site; at the pre-demolition meeting before commencement of the work, verify with the City of Delray Beach all objects to be removed and all objects to be preserved.

3.10 DEMOLITION

A. Pull out any existing utility lines designated for abandonment, irrigation, electrical lines, pull boxes and splice boxes to be removed and all other objects designated to be removed or interfering with the work. Contact the utility company or agency involved for their requirements for performing this work. No removed equipment and materials shall be allowed to remain in the work area after the day it was removed.

B. Remove all debris from the site and leave the site in a neat, orderly condition to the full acceptance of the City of Delray Beach. No debris shall be left on the site over night.

3.11 REMOVAL OF DEBRIS AND DISPOSAL OF MATERIAL

A. Material resulting from demolition and not scheduled for salvaging shall become the property of the Design-Build Team and shall be removed from site and legally disposed of off-site. Disposal shall be timely, performed as promptly as possible and not left until the final cleanup.

B. Remove from site contaminated, vermin infested, or dangerous materials encountered and dispose of by safe means so as not to endanger health of workers and public.

C. Burning of removed materials from demolished structures will not be permitted on-site.

3.12 COMPLETION OF WORK

A. Leave the site in a neat, orderly condition to the full acceptance of the City of Delray Beach.

B. Dirt remaining after demolition shall be graded level and compacted, in preparation for filling operations to follow demolition. Trenches shall be filled in layers of 12" maximum thickness and compacted in accordance with the technical specifications applicable to backfilling of trenches.

END OF SECTION

SECTION 030000 - CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Work of this section shall conform to the requirements of the Contract Documents, including the General Conditions, Supplementary General Conditions, Special Conditions, and Division 1 General Requirements.

1.02 DESCRIPTION

A. Work Included: The extent of the concrete work is indicated on drawings and specified herein. Concrete Work includes, but is not limited to, the following:

1. Cast-in-place stone concrete.
2. Reinforcing steel.
3. Concrete admixtures.
4. Formwork.
5. Curing of concrete.
6. Finishing of concrete.
7. Protection of concrete.
8. Plastic waterstops.
9. Expansion Joint Fillers.

1.03 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. ACI 301 "Specifications for Structural Concrete for Buildings".
2. ACI 318 "Building Code Requirements for Reinforced Concrete".
3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

B. For any item not specifically covered in these specifications, ACI 301-81 "Structural Concrete for Buildings" will govern.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s product data with applications and installation instruction for materials and items, including but not limited to, reinforcement and forming accessories, admixtures, waterstops, and others as requested.

B. Shop Drawings: Reinforcement - Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" and as shown on the drawings, showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement if required.

1. All reinforcing steel is to be precut off-site in an approved fabricating shop by an approved Subcontractor for reinforcing steel fabrication.

C. Laboratory Test Reports: Submit laboratory test reports for mix designs as specified.

D. Mix Design: This Contractor shall submit a mix design for each type of concrete required for approval by the Engineer. Refer to Part 4 of this Section for additional requirements.

E. Material Certificates: Submit certificates for reinforcing steel as hereinafter specified.

F. Admixture(s) Certification(s): Submit certifications(s) as hereinafter specified.

1.05 JOB CONDITIONS

A. Time of Completion and Procedure of Construction: Time of Completion is a matter of utmost importance in connection with this Contract. By the submission of a bid, this Contractor agrees to diligently perform his work so as to assure completion within the time limits and Pre-Bid CPM Schedule.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Forms for Concrete: Construct all formwork for concrete surfaces with plywood, lumber, or metal. Provide lumber dressed on at least two (2) edges and one (1) side for tight fit. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without objectionable bow or deflection.

B. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: Reinforcing steel must be correctly rolled to section and free from all surface defects and shall be in accordance with ASTM A-615, Grade 60, as evidenced by manufacturer's certificates. The grade of steel shall be intermediate, new billet stock. All bars shall be deformed and rolled with raised symbols to identify the manufacturer and the size of the bar.

B. Tie wire shall be No. 18 U.S. Steel wire gauge black annealed wire.

C. Supports for Reinforcement: Spacerbars, slab bolsters, chairs, wiring, nails, and other accessories shall be standard commercial metal supports and plastic where exposed to weather or where rust will impair architectural finish.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C-150, Type 1.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C618, Type F may be used up to a maximum of 25% of the total cementitious content.

2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120 may be used up to a maximum of 40% of the total cementitious content.

3. The exact percentages used shall be based on a successful test placement on-site.

C. Fine Aggregate: Clean, natural siliceous sand, consisting of hard, strong, durable, uncoated particles, and shall conform to the requirements of ASTM C-33.

D. Coarse Aggregate: Clean, hard, uncoated, strong, durable gravel, or crushed stone, and shall conform to the requirements of ASTM C-33. The maximum size of coarse aggregate shall be 1 inch.

E. Water: Potable for mixing and curing concrete and shall not contain amounts of impurities injurious to the concrete.

F. Light Weight Aggregate: Conform to ASTM C-330.

2.04 ADMIXTURES

A. General: No admixtures shall be used in concrete unless otherwise specified herein and except with the permission of the Structural Engineer and after laboratory design mix approval. This Contractor shall provide the services of the admixture manufacturer's representative to assure proper use of admixtures if required.

1. Prohibited Admixtures: Calcium chloride, thicoyanates containing more than 0.05% chloride ions are not permitted. Admixtures containing more than 0.05% chloride ions are not permitted.
2. Certification: Written conformance to the above mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Engineer.

B. Water Reducing Admixture: Conform to ASTM C-494, Type A. Provide one of the following products:

1. W.R. Grace & Co. - "WRDA with Hycol"
2. Master Builders - "Pozzolith 322N"
3. The Euclid Chemical Company - "Eucon WR-75"
4. Sika Chemical Corp - "Plastocrete 161"

C. Accelerating Admixture: Non-chloride, non-corrosive and conform to ASTM C-494, Type C & E.

1. The Euclid Chemical Co. - "Accelguard 80"
2. W.R. Grace & Co. - "Daraset"
3. Master Builders - "Pozzolith 500A"

D. Air Entraining Admixture: The air-entraining admixture shall conform to ASTM C-260 and shall be used where necessary to achieve the specified air content.

E. Water Reducing Retarder Admixture: Conform to ASTM C-494, Type D.

1. The Euclid Chemical Co. - "Eucon Retarder-75"
2. W.R. Grace & Co. - "Daratard-17"
3. Sika Chemical Corp - "Plastocrete 161-R"
4. Master Builders - "Pozzolith 100-XR"

F. High Range Water Reducing Admixture: Conform to ASTM C-494, Type F. These admixtures shall be used in strict accordance with the manufacturer's recommendations. Provide one of the following products:

1. W.R. Grace & Co. - "Daracem - 100"
2. Sika Chemical Corp - "Sikament"
3. The Euclid Chemical Co - "Eucon-37"
4. Master Builders - "Rheobuild 716"

2.05 RELATED MATERIALS

A. Anchor Bolts: Anchor bolts shall be ASTM A-307. For size and length of anchor bolts refer to the Structural drawings.

B. Joint Fillers: Expansion joint fillers shall be asphalt impregnated fiberboard conforming to ASTM D-1751. Joint fillers shall extend full depth of joint and be of thickness indicated on drawings.

C. Waterstops: Provide flat, dumbbell type or center bulb type waterstops at construction joints and other joints as shown. Size to suit joints.

D. Non-Shrink Grout: Pre-mixed non-shrink grout as called for on drawings shall be as manufactured by:

1. The Euclid Chemical Co. - "Euco N-S Grout" (All exposed grout).
2. The Euclid Chemical Co. - "Firmix"

3. Master Builders - "Masterflow 713 Grout"

4. U.S. Grout Corporation - "Five Star Grout"

5. Lambert Corp. - "Vibropruf #11"

E. Curing Compounds: Curing compounds shall be manufactured by:

1. "Super Floor Coat" or "Super Rez Seal" by the Euclid Chemical Company, "Masterseal" by Master Builders, or approved equal, for curing and sealing all garage, exterior exposed, and mechanical room floors. The compound shall be a clear styrene acrylate

type, 30% solids content minimum moisture loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon. Manufacturer's certifications required.

2. Other interior slabs shall be cured with the dissipating resin type compound, "Kurez DR" by The Euclid Chemical Company or approved equal. The compound shall conform to ASTM 309 and chemically break down in a two to four-week period. The curing compounds must be applied immediately after finishing and on formed surfaces following form removal.

F. Plastic Reglets: Provide "Type A" prefilled P.V.C. reglets where indicated, made by Superior Concrete Accessories, Inc. Install in strict accordance with manufacturer's details and directions.

G. Bonding Compound: The compound shall be polyvinyl acetate, rewetable type, "Euco Weld" by The Euclid Chemical Company or "Weldcrete" by The Larsen Company.

H. Epoxy Adhesive: The compound shall be a two (2) component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces, "Euco Epoxy #463 or #615 " by The Euclid Chemical Company or "Sikadur Hi-Mod by Sika Chemical Corporation.

1. Polyvinyl chloride (PVC) waterstops: Corps of Engineers CRD-C 572.

2.06 CONCRETE PROPORTIONS

A. All mix designs shall be proportioned in accordance with Section 4.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318-83. Submit mix designs on each class of concrete for review. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve a compressive strength 1200 psi higher than the specified strength. This over-design shall be increased to 1400 psi when concrete strengths over 5000 psi are used. All proposed mixes shall be submitted for approval prior to the start of concrete operations.

B. Cement, aggregate and other materials required for design or verification mixes by the laboratory shall be supplied by this Contractor.

C. Measurements of fine and coarse aggregate shall be made separately by weight. The proportioning of aggregate for fractional sacks of cement will not be permitted unless the cement is weighed for each batch. Weighing equipment shall be arranged to permit making compensation for changes in the weight of moisture contained in the aggregate.

D. Batching equipment shall be subject to inspection and approval.

E. Design Mixes to provide normal weight concrete with the following properties, as indicated below, unless otherwise indicated on drawings and schedules.

1. Self-Consolidating Concrete: Use where indicated on the plans. Minimum flow of 20” or as required by the successful test placement. All self-consolidating concrete shall contain the specified high-range water-reducing admixture and viscosity-modifying admixture as required. Required workability, pumpability, surface finish, and setting time must be verified with a successful test placement onsite.

2. "Quick Dry" Concrete: Maximum W/cm – 0.40, superplasticized, 3% maximum air content. The floor finish shall be as required by the manufacturer of the specified floor coating or covering.

F. Water-Cement Ratio: Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:

5000 psi, 28 day compressive strength; W/C ratio, 0.42 maximum (non air entrained), 0.32 maximum (air entrained).

4000 psi, 28 day compressive strength; W/C ratio, 0.45 maximum (non air entrained), 0.35 maximum (air entrained).

3500 psi, 28 day compressive strength; W/C ratio, 0.48 maximum (non air entrained), 0.40 maximum (air entrained). Use for all steel troweled interior slabs subject to vehicular traffic. Include structural fibers in all loading dock slabs and toppings at the rate of 5 lbs. per cubic yard

3000 psi, 28 day compressive strength; W/C ratio, 0.52 maximum (non air entrained), 0.46 maximum (air entrained).

2500 psi, 28 day compressive strength; W/C ratio, 0.54 maximum (non air entrained), 0.50 maximum (air entrained).

G. Lightweight Concrete - Proportion mix as specified. Design mix to produce strength and modulus of elasticity as noted on drawings, with a splitting tensile strength factor (Fct) of not less than 5.5 for 3000 psi concrete and a dry weight of not less than 95 lbs. or more than 110 lbs. after 28 days. Limit shrinkage to 0.03 percent at 28 days.

H. Admixtures

1. Use water-reducing admixture or high range water-reducing admixture (super plasticizer) in all concrete.

2. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg. F. (10 deg. C.).

3. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point if placement having air content within following limits:

a. Concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure:

b. 3% to 5% for maximum 1" aggregate.

4. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.

I. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement of 4 inches plus or minus 1 inch. Concrete containing HRWR admixture (superplasticizer): Not more than 8 inches.

2.07 MIXING

A. Job Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd., or fraction thereof.

1. Provide batch ticket for each discharged and used in work, indicating project identifications name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Ready-Mix Concrete: Comply with requirements of ASTM C- 94, and as herein specified.

1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C-94 shall be required. When air temperature is between 85°F (30°C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMS

A. Forms shall be so constructed that the finished concrete will conform to the shapes, lines, and dimensions shown on the Contract drawings. They shall be substantially built and sufficiently tight to prevent leakage of water or paste and securely braced in order to maintain their true position and shape. If any form loses its proper shape or position, it shall immediately be repaired to the satisfaction of the Architect or removed and replaced with a new form. Provide cleanout openings.

B. Earthcuts shall not be used as forms for vertical surfaces.

C. The design and engineering of the formwork, as well as its construction, shall be the sole responsibility of this Contractor.

1. Formwork design, tolerances of finished lines, and camber to compensate for deflections due to weight of concrete shall conform to "Recommended Practice for Concrete Formwork (ACI-347)", or as otherwise noted.

D. Form Ties

1. Factory-fabricated, adjustable length, removable, or snap off metal form ties designed to prevent deflection and to prevent spalling concrete surfaces upon removal.

a. Provide ties so that portion remaining within concrete after removal of exterior parts is at least 1-1/2 inches from the outer concrete surfaces.

E. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

F. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, woods, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT

A. Reinforcement fabricated to the shapes and dimensions shown or required shall be placed where indicated on the Contract Documents.

B. Before any reinforcement is placed, any loose rust of mill scale or coatings, including ice or oil, which would reduce or destroy the bond, shall be removed. Reinforcement materially reduced in section shall not be used.

C. Concrete cover over steel reinforcement shall be as shown on the drawings.

D. Bar reinforcement shall be carefully formed to the shapes shown and required to resist most effectively the stresses involved. Bars with kinks or bends not required shall not be used. The reinforcing shall not be bent or straightened in a manner which would injure the material. The heating or reinforcement for bending or straightening will not be permitted.

E. Bends or hooks, unless otherwise shown or required, shall be cold formed around pins. Hooks shall be ACI Standard.

F. Reinforcement shall be wired securely at intersections and shall be held in place with approved bars, spacers, chairs, high chairs, bolsters, or other supports so that it will not be dislocated or otherwise disturbed during the depositing of concrete.

G. Steel reinforcement shall not be spliced at points of maximum stress. Laps in adjacent bars shall be staggered. Laps shall be tied and seized tight at both ends.

H. All dowels shall be secured and tied in place before pouring concrete.

I. Reinforcing steel shall be stored under cover and protected from rusting, oil, grease, or distortion.

3.03 CONSTRUCTION JOINTS

A. Where indicated, construction joints shall be of the types and at the locations indicated on the drawings and specified hereinafter. All other construction joints shall be submitted to the Structural Engineer for approval.

B. Construction joints shall be provided with adequate shear keys for succeeding placements and reinforcement shall be continuous through such joints. No bars shall be continuous through two construction joints.

C. The Contractor shall have means at hand to bring any grade beam placement to an emergency construction joint provided with the proper shear key and/or dowels if an interruption in the supply of concrete or inclement weather makes such a procedure necessary.

D. Waterstops as specified shall be provided at all construction joints in concrete work in elevator pit walls, piping pits, and where indicated on drawings.

E. No horizontal joints will be permitted in walls and grade beams except as shown in the drawings.

F. Unless otherwise noted, the maximum spacing of construction joints should be as follows:

1. Foundation walls and grade beams - forty (40) feet.

3.04 INSTALLATION OF EMBEDDED ITEMS

A. Provide anchor bolts for steel column template at correct elevations as shown on the drawings.

B. Anchor bolts shall be set in location in plan and shall not exceed tolerances specified in AISC "Specifications for Design, Fabrication, and Erection of Structural Steel for Buildings", including the "Commentary" and Supplements thereto as issued.

3.05 CONVEYING AND PLACING

A. Concrete shall be conveyed from the mixer to the forms as quickly as possible by a method which will prevent segregation and loss of materials.

B. Delivery carts and/or buggies where used shall be kept on temporary runways built over the construction, and runway supports shall not bear upon reinforcing steel or fresh concrete.

C. Belt conveyors, chutes or similar equipment will be permitted.

D. Concrete shall not be placed on loose fill, mud or standing water.

E. Concrete shall be deposited continuously. Deposit concrete as nearly as practicable to its final location to avoid segregation.

F. Concrete shall not be incorporated in the work after it has attained its initial set not in any event more than one hour after water has been added to the aggregate.
This period may be reduced at the option of the Joint Venture if it develops that presetting is taking place, particularly in hot weather.

G. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling. Special care shall be exercised to prevent splashing of forms or reinforcement with concrete in advance of pouring.

H. Pumped Concrete - All concrete placed by pumping method shall be proportioned in accordance with the provisions of ACI 211.1 to meet the requirements of

strength, slump, and air content in these specifications. Test cylinders for strength and tests for slump air content shall be taken at the point of discharge from the pumping line.

I. Concrete shall not be allowed to drop freely more than 6 feet. Provide pour holes in formwork for placement of concrete where the drop exceeds 6 feet.

J. Chute shall be thoroughly cleaned before and after each run. All waste materials and flushing water shall be discharged outside of the forms.

K. After form removal, all tie holes and other repairable defective areas shall be immediately patched.

3.06 COMPACTION AND VIBRATION

A. Concrete shall be compacted with the aid of mechanical internal vibrating equipment supplemented by hand spading, rodding and tamping to force out air pockets, to work the materials into the corners and around reinforcement and embedded items, and to eliminate honeycomb.

3.07 COLD WEATHER PLACEMENT

A. In temperatures of 40 deg. F. and above, when it is not anticipated that temperatures will drop below 40 deg. F, comply with the requirements of ACI.

B. For temperatures below 40 deg. F, concrete must be delivered to the project site between 55 deg. F. and 70 deg. F, comply with the requirements of ACI. Water shall not be heated over 180 deg. F.

C. Use only the specified non-corrosive, non-chloride accelerator. Calcium Chloride, thiocoyanates or admixtures containing more than 0.05% chloride ions are not permitted.

D. All methods proposed for heating materials and protecting the concrete shall be subject to approval by the Structural Engineer. Concrete shall never be heated over 90 deg. F, nor will any other overheating which would produce a flash set be permitted.

E. Do not place concrete on frozen subgrade or subgrade containing frozen materials, snow or ice.

3.08 WARM AND INCLEMENT WEATHER PLACEMENT

A. During hot weather, the concrete shall be delivered to the forms at the coolest practicable temperature. In no case shall concrete above 90 deg. F. be placed. When high temperatures and/or placing conditions dictate, the Contractor shall use the water-reducing, retarding formulation (Type D) in lieu of the specified water-reducing admixture (Type A) as specified. Concrete shall not be placed when the sun, heat, wind, rain, sleet, or humidity would prevent proper placement.

3.09 CONCRETE FINISHES

A. Troweled Finish: All concrete slabs, except as noted below, but including those that shall receive resilient flooring, tile with a thin set application, or carpet shall be screeded level to the established elevations, thoroughly consolidated and bullfloated. When slabs have set sufficiently, machine float and then trowel with a steel trowel. Concrete shall be in condition acceptable to trades that will furnish and install the finish materials.

1. During the floating and troweling operations, care shall be taken that no holes or depressions are left from the removal of coarse aggregate and that no excess moisture or bleed water is present on the surface. The trowel finished surface shall be level so that the surface conforms to an F25 number as measured by the "Dipstick" or an optical device approved by the Architect.

B. Scratched Finish: For slab surfaces intended to receive bonded applied "mud set" cementitious applications, ceramic tile or quarry tile, etc., after concrete has been placed, struck-off consolidated and leveled, the surface shall be roughened with stiff brushes or rakes before final set.

3.10 FINISHES OTHER THAN FLOORS

A. Smooth Finish: All vertical concrete surfaces that will be exposed as finished work shall receive a smooth finish. This shall be achieved by the use of steel forms or new smooth plywood. Sheets shall be as large as possible with smooth even edges and installed with close joints. Joint marks and fins shall be ground off and surfaces left smooth, dense, and free from honeycombing, prominent grain marking, and bulges or depressions more than 1/8" in 4 feet. Surfaces shall then be patched, leaving the surface finish uniformly smooth and washed clean.

B. Rough Finish: Rough concrete finish shall be used for all other concrete for which no other finish is indicated or specified. Obtain by using clean, straight lumber, plywood, or metal forms. Concrete having a rough finish shall have honeycombing and minor defects patched.

3.11 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Immediately after placing and finishing, concrete surfaces not covered by forms, or when forms are removed within three days of placement, shall be protected from the loss of surface moisture for a period of not less than seven days by covering with the curing compound specified.

2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

3.12 REPAIR OF DEFECTIVE AREAS

A. All Structural repairs shall be made with prior approval of the Structural Engineer, as to method and procedure.

3.13 REDESIGN

A. Changes or departures from the construction details shown on the drawings shall be made only with the approval of the Structural Engineer.

B. Changes will not be allowed to be made on shop drawings that have been previously submitted for approval except for items that have been noted for corrections or coordination.

3.14 BONDING

A. Before new concrete is deposited on or against concrete that has hardened, the form shall be retightened, the surfaces of the hardened concrete shall be roughened as required, thoroughly cleansed of foreign matter and laitance, and slushed with cement grout.

PART 4 - QUALITY CONTROL TESTING

4.01 TESTING AND INSPECTION

A. General: The Contractor shall pay for the services of a test laboratory for selected by the City for concrete quality control as enumerated in this specification. The test laboratory shall submit proof that any concrete inspectors used on the project shall have taken and passed the ACI course in Concrete Inspection within the past five years. The test laboratory services shall include the following:

1. The testing laboratory shall provide continuous inspection and testing of ingredients used in concrete.

2. The test laboratory shall keep a man on the job site for the full length of all concrete placements and if requested, shall check the batching plant quantities and measurements at the beginning of each day's placement.

3. The test laboratory shall make tests during the progress of the work and shall check for adequate mixing of all concrete placed.

B. Codes: The testing laboratory, will test the concrete for compliance with contract documents and all applicable ACI and ASTM codes and standards.

C. Understrength Concrete: If test cylinders fail to meet the strength requirements and/or if, in the opinion of the Structural Engineer, the cylinders are not truly representative of the inplace concrete the Architect has right to request that cores be cut from the work affected. Such cores shall be not less than 3 in number and shall comply as to size and shape and shall be secured and tested in conformance with the requirements of ASTM C42. The cores shall be taken at points mutually agreeable to the Contractor and the Architect, and shall be tested at points mutually agreeable to the Contractor and the Architect, and shall be tested in the presence of the Architect by a laboratory approved by the Architect. If test results are not satisfactory to the Architect, this Contractor shall remove from the work all affected concrete and replace such defective work in a satisfactory manner, all without further compensation or time extension including the costs of coring, testing and all related architectural and engineering work.

D. Contractor's Respon¬sibility: The sole responsibility for producing concrete in the field having the strength required without causing excessive shrinkage cracks shall rest on the Contractor, regardless of the laboratory determination. If, in his opinion, the field conditions are such that a lower water-cement ratio is necessary to produce the required strength, he shall submit the mix he proposes to use to the Architect in writing. In no case will the Contractor be permitted to use a higher water-cement or lower cement factor than those used in the approved mix.

E. Redosage with the high range water reducing admixture (superplasticizer) may be permitted with the approval of the Engineer as to methods and procedures.

4.02 TESTING DURING PROGRESS OF WORK

A. If requested, batch plant inspection by the testing laboratory will include:

1. Attendance at the batching plant during all batching.

2. Determination that all weighing and measuring equipment is in proper working order and that calibration certificates of scales are current.

3. Determination that the truck mixers are regularly cleaned and maintained and that the drums revolve at the proper speeds. Provide the Joint Venture with a list of trucks certified in accordance with ASTM C-94. No mixers with accumulations of hardened concrete on the blades or with worn or defective blades shall be permitted on this project.

4. Ascertain that only correct weights of cement and aggregate are used.

5. Ascertain that only those admixtures as specified and in proper qualities are used in the mix.

6. Insure that only the correct amount of mixing water is loaded into the tank of the truck.

7. Insure that only approved materials are used.

8. Ascertain that aggregates and water are of the proper temperature.

9. Make necessary tests of the aggregates to determine the moisture content so that the total water in the batch may be properly adjusted.

10. Test of aggregates received at the batching plant for gradation and cleanliness.

11. Check and sign delivery tickets issued by supplier that will identify each load of concrete dispatched to the project as having been inspected.

B. Field Inspection by the Testing Laboratory will include:

1. Attendance at the project site during all concrete placing operations.

2. Ascertain that concrete delivered to the site has been inspected by the batch plant inspector.

3. Control the addition of mixing water in order to maintain the required water/cement ratio.

4. Ascertain that the concrete is mixed in accordance with the specification requirements.

5. Insure that the concrete is conveyed from the mixer to the point of pour in accordance with specifications and good practice.

6. Insure that the concrete is of the proper temperature when placed.

7. Air Content Tests - At least two tests shall be made for each day's placing or from each batch of concrete from which cylinders are cast. Tests shall be representative of each type of concrete.

8. Slump Tests - At frequent intervals to properly control the consistency and at least one at time of casting each group of cylinders and at least one test for every 25 cubic yards.

C. Concrete Compression Cylinders: Unless otherwise specified, there shall be taken from the concrete of each strength placed on any one day at least one set of five representative 6" x 12" test cylinders. For large placements on any one day there shall be taken not less than one set of five representative type cylinders for each 100 cubic yard of concrete of each strength placed. Two cylinders to be tested at 7 days, two at the age of 28 days and the fifth cylinder in reserve for further testing. Ascertain that the test specimens are properly protected until shipped to the testing laboratory. Record and identify each cylinder with the location of the concrete from which the specimen was taken. Keep marking in sequence.

D. Additional Test Lab Responsibilities: Report any material or work performed that fails to meet the job specifications immediately with the Contractor, and then to the Architect. Work will be checked as it progresses. Failure to detect any defective work or materials shall not in any way prevent later rejections or obligate the City for final acceptance.

E. Reports on Inspection: Submit reports on testing and inspection. Reports shall include detailed data with respect to all requirements of the specifications referenced. Materials or workmanship not meeting the requirements of the Contract Documents, either at the plant or project site, will be rejected by the Testing Laboratory and immediately reported to the Contractor and then to the Architect. In no case shall the laboratory recommend any method of adjustment or correction without obtaining prior approval of the Architect. Include in all reports and project title and number, location, Contractor's name, and date work was performed.

F. Report Copies and Timing: Immediately after tests or inspections have been made and in no case late than seven (7) days after tests of inspection have been made, the laboratory shall furnish copies of all test and inspection reports.

1. One (1) copy to Architect.

2. One (1) copy to the Contractor.
3. One (1) copy to Master Consulting Engineers, Inc.
4. One (1) copy to Concrete Contractor.
5. One (1) copy to the City.

G. Batch Plant Inspection Daily Report: The batch plant inspectors shall submit a daily report which shall contain the following data:

1. Concrete supplier.
2. Weather conditions and air temperature (ranges).
3. Type of concrete.
4. Required strength of concrete.
5. Total number of batches, batch weight, and identifying number of each batch and truck load.
6. Basic control data concrete mix, indicating mix number source, and type of cement, source of aggregates, type of admixtures, basic quantities of cement, aggregates (dry), water and admixtures of concrete per cubic year, required slump, required air entrainment and water/cement ratio.
7. Actual data and quantities of concrete batch, indicating time of batching, actual quantities of cement, aggregates (moist) and admixtures, gallons of water added to plant; percent of total moisture in aggregates; temperature of aggregates and water, gallons of water to be added in transit or at site; time truck dispatched from plant.
8. Name of inspector, with time of arrival and departure from batch plant and total hours for day.

H. Site Inspection Daily Report: The site inspectors shall submit a daily report which shall contain the following data:

1. Concrete supplier.
2. Weather conditions and air temperature (ranges).
3. Class and type of concrete placed.
4. Location of placed concrete and time of starting and stopping of placement.
5. Identification of truck loads.
6. Time of dispatching truck from batching plant and receipt of delivery tickets. Indicate delivery ticket number.
7. Amount of water added in transit or at site.
8. Time of discharging concrete from truck.
9. Temperature of concrete during discharging from truck and during placing.
10. Slump test results, identifying truck load and cylinders made.
11. Air entrainment test results, identifying truck load.
12. Test cylinders cast, identifying cylinder number, design strength, time taken, slump, truck numbers from which taken and location of pours with yardage of concrete placed at each location.
13. Weight per cubic foot of plastic concrete.
14. Other pertinent data which may have bearing on quality or strength of concrete, placing of concrete, and also report if any concrete was rejected.
15. Name of inspector, with time of arrival and departure from site and total hours for day.

4.03 CONTRACTOR'S RESPONSIBILITIES AND OBLIGATIONS RELATIVE TO CONCRETE MIX DESIGNS

A. This Contractor shall submit preliminary mix designs for the concrete proposed on this project for review.

B. The preliminary mix design shall be prepared by a concrete test lab and shall be based on the actual materials used as submitted by this Contractor.

C. Furnish an insulated weatherproof box for storing field test.

D. The test lab cost for the above shall be borne by this Contractor.

4.04 THE TESTING LABORATORY SHALL FURNISH ALL REQUIRED CYLINDER MOLDS AND TAGS TO BE USED FOR MIX DESIGNS AND FIELD TESTS.

END OF SECTION

SECTION 030500 – COMMON WORK RESULTS FOR POOL DECK CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of clear, acrylic, slip resistant concrete sealer.

1.02 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCES

A. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

1.04 SUBMITTALS

A. Comply with Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.05 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 a clean dry area in accordance with manufacturer's instructions.

C. Keep product from freezing.

D. Avoid direct contact with this product as it may cause irritation of the eyes and/or skin.

E. Protect materials during handling and application to prevent damage or contamination.

F. Do not mix with any compound containing solvent.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not apply product when air, surface, or material temperatures are expected to fall below 40ºF (4ºC) within 4 hours of expected application.

B. Do not apply to frozen concrete.

C. Do not use on dense or porous surfaces.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com or approved equal.

2.02 MATERIALS

A. Performance Based Specification: Acrylic concrete sealer shall be a water-base, non-yellowing, clear, slip-resistant compound meeting the following requirements:

1. ASTM C1315 Ultraviolet Resistance – Class A - Non-yellowing.
   Chalk Resistance – No chalking.
   Check/Peel Resistance – No deterioration.
2. Dried film accepted by USDA.
3. Meets the maximum VOC content limits of 200 g/L for Concrete Curing and Sealing Compounds as required by the California Air Pollution Control Districts.
4. Meets the 400 g/L VOC maximum required by the U.S. EPA Architectural Coatings Rule.

B. Proprietary Based Specification: DECK-O-GRIP W/B Non-Yellowing, Slip-Resistant, Acrylic Concrete Sealer by W. R. MEADOWS or approved equal

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive concrete sealer. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive sealer.

B. Clean and prepare surfaces to receive sealer in accordance with manufacturer's instructions, ensuring that all stains, oil, grease, form release agents, dust and dirt is removed prior to application.

C. Ensure surface is clean and free from all powdered release agent residue.

D. Apply concrete sealer when concrete surface is clean and dry.

3.03 APPLICATION

A. Apply sealer in accordance with manufacturer's instructions.

B. Mix or agitate concrete sealer thoroughly avoiding excessive mixing.

C. Apply a uniform film using a standard industrial-grade sprayer, sprayed with an 8001 tip that produces a flow of 1/10 of one gallon per minute. Alternatively, apply using a short nap roller.

D. Apply a second coat at right angles to the first for added protection if required.

E. Stir occasionally during application to ensure particles remain suspended.

3.04 PROTECTION

A. Restrict foot traffic for at least 6 hours, 12 hours is preferable.

END OF SECTION

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 DESCRIPTION

1.2 RELATED SECTIONS

A. 032000 - Concrete Reinforcement

B. 033000 - Cast-in-Place Concrete

C. 042214- Masonry Patchwork

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1 D99/D994M-11 (2016) Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

2 E154/E154M-08a (2019) Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls or as Ground Cover.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1 ACI 117/117R - Tolerances for Concrete Construction and Materials.

2 ACI 301 - Specifications for Structural Concrete for Buildings.

3 ACI 318 - Building Code Requirements for Reinforced Concrete.

4 ACI 347R - Guide to Formwork Concrete.

B. Qualifications:

1 Formwork Engineer: Professional engineer, with Florida registration and experience in design of formwork and related items.

2 Formwork Contractor: Florida licensed contracting firm having 5 years successful experience in fabrication and erection of formwork systems of similar scope and complexity as required for this project. Contractor shall have sufficient capacity to produce formwork without causing delay in work.

1.5 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

1.6 FORMWORK AND RESHORING DESIGN

A. Formwork:

1 Comply with Chapter 4 of ACI 301

2 Formwork engineer shall perform or oversee design, drawings, erection, and removal.

3 Design according to ACI 117 and ACI 347, including provisions for construction loads and placing equipment to be used on project.

4 Verify strength and stiffness of in-place building elements to resist required loads and restrict deformations to specified tolerances.

5 Earth cuts shall not be used as forms for vertical surfaces. Natural rock formations maintaining a stable vertical cut may be used as side forms. Comply with OSHA's "Trench Safety Act".

6 Design and Installation of Formwork: Form ties that leave through holes in the concrete are not allowed.

7 Removal Strength:
- a Wall forms and column forms may be removed 12 hours after pouring.
- b Beams and other slabs shall not have forms removed until the concrete has achieved 75 percent of its design strength. Beams shall be reshored immediately upon removal of forms.
- c In addition to the above, flat slab forms and stair slab forms shall not be removed for 5 days. Upon removal of forms, reshores shall be placed and remain in place until concrete is 14 days old.

B. Reshoring:

1 Design reshoring to resist active loads.

2 Space shoring so no lower floor or member will be excessively loaded from design live loads or will induce tensile stress in concrete members where no reinforcing steel is provided.

3 Extend shores beyond minimums to ensure proper distribution of loads throughout structure.

4 Consider special loading requirements to support load of special elements where elements of similar size and capacity do not exist in supporting structure below.

1.7 FORMWORK SUBMITTALS

A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items.

B. Formwork:

1 Submit shop drawings, signed and sealed by formwork engineer, for fabrication and erection of specific finished concrete surfaces as indicated. Show construction of forms as required.

2 A/E'S review is for general applications and features only. Design of formwork for structural stability and efficiency is Contractor's responsibility, and will not be reviewed.

C. Reshoring:

1. Submit shop drawings, signed and sealed by formwork engineer, for reshoring system showing:
   a Arrangement and sequencing of reshores required.
   b Specific areas where reshores do not align vertically.
   c Required installation procedures.
   d Removal criteria.

2. Submit calculations showing:
   a Loading diagrams for each floor or differently loaded area showing maximum imposed loads at each critical sequence.
   b Ratio of total load to strength at actual age.
   c Verification of member strength where shores do not align vertically.
   d Verification of structure to resist required lateral loads.

D. Foundations for Formwork and Reshoring:

1. Submit shop drawings, signed and sealed by formwork engineer, or include with formwork and reshoring shop drawings, showing:
   a Subgrade preparation required including compaction and moisture control.
   b Size and description of sill assemblies.

E. Formwork Removal:

1. Authorization for Removal: Formwork engineer shall furnish a signed and sealed report establishing the criteria for removal of formwork, shoring, and reshoring. Deviation from established criteria is not allowed.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Forms for Unexposed Finish Concrete: Form concrete surfaces to be concealed in finished structure with plywood, lumber, metal, or other material.

B. Form Ties: Ties that leave plastic tube lined holes through members are not allowed.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

D. Forming Accessories: CRD-C572-74 polyvinyl chloride (PVC).

1 Waterstops: Flat dumbbell type at construction joints and center bulb type at building expansion joints.

2 Drips: 3/8" wide x 1/2" high drip groove placed 3/4" back from edge in cast-in-place exterior soffits.

E. Premolded Expansion Joint: ASTM D994, 1/2" thick.

F. Vapor Retarder:

1. Provide moisture retarder cover over prepared base material where indicated.

2. Use polyethylene sheet not less than 15 mils thick or other materials resistant to decay when tested according to ASTM E154.

PART 3 EXECUTION

3.1 FORMS

A. Erect, support, brace, and maintain formwork to support applied vertical and lateral loads until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position.

B. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms to sizes, shapes, lines, and dimensions shown to obtain accurate alignment, location, grades, and level and plumb work in finished structures.

1 Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work.

2 Use selected materials to obtain required finishes.

3 Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

1 Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.

2 Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Provide temporary opening where interior area of formwork is inaccessible for clean out, for inspection before concrete placement, and for placement of concrete.

1 Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar.

2 Locate temporary openings on forms at inconspicuous locations.

F. Form Ties:

1 Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

2 Unless otherwise indicated, provide ties so portion remaining within concrete after removal is at least 1- 1/2" inside concrete.

3 Unless otherwise shown, provide form ties that will not leave holes larger than 1 inch diameter in concrete surface.

G. Provisions for Other Trades:

1 Provide openings in concrete formwork to accommodate work of other trades.

2 Determine size and location of opening, recesses, and chases from trades providing such items.

3 Accurately place and securely support items built into forms.

H. Cleaning and Tightening:

1 Thoroughly clean forms and adjacent surfaces to receive concrete.

2 Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed.

3.2 JOINTS

A. Construction Joints: Locate and install construction joints not shown on drawings to not impair strength and appearance of the structure, as acceptable to A/E.

B. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs, and between walls and footings. Accepted bulkheads designed for this purpose may be used for slabs.

C. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.

D. Isolation Joints in Slabs-on-Ground:

1 Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

2 Joint filler and sealant materials are specified in Division 7 sections of these specifications.

E. Contraction (Control) Joints in Slabs-on-Ground:

1. Construct contraction joints in slabs-on-ground to form panels of patterns as shown.

2. Use inserts 1/4" wide x 1/4 of slab depth, unless otherwise indicated.

F. Form contraction joints by inserting premolded hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured, remove inserts and clean groove of loose debris.

1. Contraction joints may be formed by saw cuts as soon after slab finishing as possible without dislodging aggregate.

3.3 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing materials are not acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

END OF SECTION

SECTION 03200 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Codes and Standards: Comply with the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. ACI 117/117R Tolerances for Concrete Construction and Materials.
2. ACI 301 Specifications for Structural Concrete for Buildings.
3. ACI 315 Details and Detailing of Concrete Reinforcement.
4. ACI 318 Building Code requirements for Reinforced Concrete.
5. ACI 439.3R Types of Mechanical Splices for Reinforcing Bars.
6. AWS Dl.4 Structural Welding Code Reinforcing Steel.
7. CRSI Manual of Standard Practice.
8. CRSI Placing Reinforcing Bars.
9. Wire Reinforcement Institute, Manual Standard Practice.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. A184/A184M Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
2. A615/A615-M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. A775/A775-M Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
4. A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
5. C1116/C1116M-10A Specification for Fiber-reinforced Concrete

1.3 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

1.4 SUBMITTALS

A. General:

1. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement.
   a. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement and accessories.
   b. Include special reinforcement required at openings through concrete structures.

B. Selection of splices: Splices shall be full tension, unless noted otherwise.

1. Splices noted on the drawings to be compression splices shall be furnished by one of the following:
   a. Compression lap splices according to ACI 315.
   b. Mechanical compression only connectors according to ACI 439-3R, staggered 1/2 Class "C" lap length and maintaining not less than 1/4 the total tensile capacity of any column face.
   c. Full penetration welds staggered not less than 18 diameters.
2. Splices shown on the drawings as either Class "A" or Class "B" may be one of the following:
   a. Class "B" lap splices.
   b. Class "A" (but not less than compression lap) lap splices staggered not less than one Class "B" lap length.
      1) Exception: This shall not be allowed when shown as class "B" in a location, which by design, has already accounted for other continuing bars or staggered splices.
   c. Appropriate mechanical connectors according to ACI 439-3R staggered not less than 24 diameters.
   d. Full penetration welds staggered not less than 24 diameters.
3. Unless otherwise noted in the drawings, reinforcing shall be spliced to develop the full strength of the bar in either tension or compression. Those splices shall be furnished by one of the following:
   a. Class "B" lap splices where only 1/2 of the total rebars are spliced at any one floor.
   b. Full penetration welds staggered not less than 36 diameters.
   c. Appropriate mechanical connectors according to ACI 439-3R staggered not less than 36 diameters.
4. Total steel at lap splices shall not exceed 8 percent for columns or shear wall cores containing the spliced bars.
   a. All bars may be lapped at one section for up to 4 percent steel.
   b. 1/2 of the bars may be lapped for up to 5.3 percent steel.
   c. 1/3 of the bars may be lapped for up to 6 percent steel.

d. Above 6 percent steel, other splice choices shall be used.

5. Where staggered lap splices are used, provide a mixture of bar sizes as appropriate where vertical bar size changes on the drawings.

6. Where different size bars are lap spliced, the length of splice may be based on the smaller bar size. If there is a larger quantity of the smaller bar size, the splice length shall be based on the larger bar.

7. It shall be the responsibility of the reinforcing detailer to determine the concrete strength at the point of a lap splice, the bar position (top or other), bar spacing, confinement condition based on ties or stirrups or edge condition to select the proper lap length.

8. Increase laps for bundled bars according to ACI 318, with number based on total bars in group including lapped bars.

C. Detailing of Splices: Placing shop drawings shall specifically show splice lap lengths where they occur. Bar diameter lap tables and references to other charts are not acceptable.

D. Staggered Laps Required: Provide staggered laps in any member as necessary to keep space between bars within splice zone at least 1 inch or 1 bar diameter clear.

E. Detailing of Bar Placement: For any bar other than those placed at an edge condition, between edge condition or openings, or any other location where the bar cannot be shifted longitudinally, a dimension shall be shown from an identifiable building grid, wall, or edge to at least one end of the bar.

F. Congested Areas of Placement: For any conditions resulting in bar spacing less than 2 diameters clear or where the placement of bars in one member requires critical templating to allow bar placement in an intersecting member, furnish details of sufficient scale to show clearances, spacing, and arrangements for properly placing those bars.

G. Accessories: Show accessories, supports, chairs, bolsters, and spacers necessary to complete the installation. Where supports are beyond the scope of CRSI detailing standards and custom designed supports are required, provide engineering calculations demonstrating the capacity of the system.

H. Flat Plates: Provide not less than 3 separate drawings of each plate separately showing bottom bars, top bars, and accessories.

I. Welding Submittals:

1. If welding of reinforcing bars is to be included as part of the work, submit the following:
   a. A complete welding procedure specification according to AWS Dl4.1.
   b. A certified chemical analysis of the steel to be welded.
   c. Carbon equivalence calculations according to AWS Dl4.1.

d. Qualification papers for welders who will be employed on the project. Welders shall have passed a qualification test within a 12-month period before the work or furnish a statement from a testing agency acceptable to A/E that they have observed or tested that welder's work under similar requirements within the past 6 months.

1.5 SUBSTITUTIONS

A. Reinforcing Splicing:

1. Splices shown in the drawings shall be considered mandatory for base bid purposes.

2. Alternative methods of providing for splices are available within the constraints of this specification and ACI 318.

3. If alternative splices are desired, the shop drawing submitted shall clearly indicate the change and include authorization by any other subcontractors involved in the change.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

A. Comply with Chapter 5 of ACI 301.

B. Reinforcing Steel:

1. Bars #3 through #11 shall be deformed bars according to ASTM A615 Grade 60 and according to the additional requirements of Paragraph 5.2.2.1 of ACI 301.

2. Bars #2 in size shall be plain round meeting A615 Grade 40.

3. Welded wire fabric shall be of plain wire. Welded wire fabric shall be galvanized at exterior exposed concrete.

4. Unless indicated otherwise the minimum concrete protective cover specified in Paragraph 5.7.1 of ACI 301 is the specified cover for this project unless indicated otherwise.

C. Epoxy-Coated Reinforcing Bars: ASTM A775.

D. Form-Saving Splice Connectors: Flanged devices to allow insertion of threaded reinforcing bars into a previously formed face. Available products include, but are not limited to:

1. Form Saver by Lenton.

2. DB-SAE Splices System by Richmond.

3. Rebar Flange Coupler by Williams.

E. Mechanical Connectors and Splice Devices: Proprietary products suitable for the use intended and listed in ACI 439-3R.

F. Steel Wire: ASTM A1064, plain, cold-drawn, steel.

G. Fabricated Deformed Steel Bar Mats: ASTM A184.

H. Welded Steel Wire Fabric: ASTM A1064.

I. Deformed Steel Wire: ASTM A1064.

J. Welded Deformed Steel Wire Fabric: ASTM A1064.

K. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI Class C or Class A as required acceptable.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. Provide custom supports as required to support top layer of mats and other special conditions not provided for within CRSI standards.

L. Fiber Reinforcement:

1. Manufacturers:
   a. Fibermesh by Synthetic Industries, Chattanooga, TN
   b. Ferro by Forta Corporation, Grove City, PA.

2. Comply for use in plain concrete as defined in ACI 318.1. and the following:
   a. Fibers shall not be used as a replacement for any reinforcement required for structural purposes.
   b. Blend fibers into the concrete mix according to manufacturer’s written instructions.
   c. Provide control joints according to Section 5.2 of ACI 318.1.
   d. Fibers shall comply with ASTM C1116.

PART 3 - EXECUTION

3.1 PLACING REINFORCEMENT

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as specified.

B. Clean reinforcement of loose rust and mill scale, dirt, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers as required.

D. When any reinforcing bar is placed projecting either horizontally or vertically from a given element to subsequently lap with other reinforcing bar, verify the detailed lap length will be achieved.

   1. Report any deviation to the A/E for correction before placing concrete in the first element.

   2. Bar projections resulting in laps shorter than the detailed laps shall be considered rejected, and corrective measures shall be taken at the direction of the A/E with no additional cost to the City.

E. Place reinforcement to obtain at least minimum coverages for concrete protection.

   1. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.

   2. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

F. Install welded wire fabric in as long lengths as practicable.

   1. Lap adjoining pieces at least one full mesh plus 2 inches and wire splices.

   2. Offset end laps in adjacent widths to prevent continuous laps in either direction.

G. Provide the A/E with not less than 48 hours notice before starting any welding of reinforcing bars.

   1. Welding of reinforcing bars shall only be allowed under the direct supervision of the A/E.

   2. Welding of crossing reinforcing bars is not allowed.

   3. Any bars with unauthorized or unacceptable welds shall be replaced at no additional cost to the City.

END OF SECTION

SECTION 032900 - UNDER-SLAB VAPOR BARRIER/RETARDER

PART 1 – GENERAL

1.1 SUMMARY

A. Products Supplied Under This Section
   1. Vapor Barrier, seam tape, pipe boots, detail strip for installation under concrete slabs.

1.2 RELATED DOCUMENTS

A. Specification 03 30 00 Cast-in-Place Concrete

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. STM E 1745-97 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil Or Granular Fill Under Concrete Slabs
   2. ASTM E 154-88 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
   3. ASTM E 96-95 Standard Test Methods for Water Vapor Transmission of Materials
   4. ASTM E 1643-98 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

B. American Concrete Institute (ACI)
   1. ACI 302.1R-96 Vapor Barrier Component

1.4 SUBMITTALS

A. Quality Control / Assurance
   1. Independent laboratory test results showing compliance with ASTM & ACI Standards.
   2. Manufacturer’s samples, literature
   3. Manufacturer’s installation instructions for placement, seaming and pipe boot installation

PART 2 – PRODUCTS

2.1 MATERIALS

A. Vapor Barrier (Performance based specification)
   1. Vapor Barrier membrane must have the following properties.
      A. Minimum WVTR as tested by ASTM E96 of 0.008
      B. Water Vapor Barrier ASTM E-1745 Meets or exceeds Class B

D. Water Vapor Transmission Rate ASTM E-96 0.006 gr./ft2/hr. or lower
E. Permeance Rating ASTM E-96 0.01 gr./ft2/hr. or lower
F. Puncture Resistance ASTM E-1745 minimum 1970 grams
G. Tensile Strength ASTM E-1745 minimum 45.0 lbf/in

2. Vapor Barriers
A. Stego (15mil) Vapor Barrier by STEGO INDUSTRIES LLC.
B. W.R. Meadows Premoulded Membrane with Plasmatic Core
C. Vaporguard by Reef industries.

2.2 ACCESSORIES

A. Seam Tape
1. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4 inches.

B. Pipe Boots
2. Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

PART 3 – EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by architect
1. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION

A. Install Vapor Barrier:
1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643–98.

A. Unroll Vapor Barrier with the longest dimension parallel with the direction of the pour.
B. Lap Vapor Barrier over footings and seal to foundation walls.
C. Overlap joints 6 inches and seal with manufacturer's tape.
D. Seal all penetrations (including pipes) with manufacturer's pipe boot.
E. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
F. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with tape.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:

1. 031000 - Concrete Formwork.
2. 032000 - Concrete Reinforcement
3. 078413 – Penetration Firestopping.
4. 072600 – Vapor Retarders
5. 079500 – Expansion Control.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. C78-94 Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
3. C150 Specification for Portland Cement.
4. C260 Specification for Air-Entraining Admixtures for Concrete.
5. C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
6. C494 Specification for Chemical Admixtures for Concrete.
7. D1751 Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
8. D1752 Specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.3 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

1.4 SUBMITTALS

A. Submit shop drawings for reinforcement and accessories

1. Detail beams and reinforcing in elevation and not in schedules.

2. Show slab reinforcing in plan view, similar to the structural drawings, not scheduled, and drawn to a minimum scale of 1/8" = 1'-0". Show reinforcing on the plan view along with size, quantity, marks, and spacing.

3. Detail walls and reinforcing in elevation and not in schedules.

4. Other items may be detailed as needed.

5. A/E will not review drawing submitted not complying with these requirements. Contractor shall verify detailing proceeds as specified to avoid untimely reinforcing arrival.

B. Materials and methods of curing.

C. Concrete materials and mix designs.

D. Certifications required for admixtures (chloride and solids).

E. Chlorides in concrete.

F. Test reports.

G. Waterstops and premolded joint fillers.

H. Curing compounds.

1.5 STANDARDS

A. Concrete work shall comply with requirements of ACI 301- Specifications for Structural Concrete for Buildings, except as specified.

B. The Contractor shall familiarize himself with the requirements of ACI 301 and this specification.

C. The requirements that follow are listed in the sequence of chapter numbers of ACI 301 for ready reference purposes.

D. Florida Building Code (FBC).

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with Chapter 1 of ACI 301.

B. Portland cement: ASTM C150, Type 2. Provide from one source with C3A content less than 8% for slab on grade.

C. Fine aggregates: Natural quartz sand or sand manufactured from local stone aggregates conforming to ASTM C33, produced from F.D.O.T. approved sources, with fineness modulus not less than 2.4, and having a proven service record.

D. Detectable Stone Transition Strip: 1.5” avg. size, cleaned, washed White River Rock (Egg Rock). Submit samples for approval by Landscape Architect.

E. Water: Clean and potable, free from deleterious amounts of acids, alkalis, salts and organic matter.

2.2 MATERIALS FOR CONCRETE

A. Comply with Chapter 2 of ACI 301 and the following:

1. Cement: Type I or III complying with ASTM C150.

2. Admixtures:

a. Water Reducing Admixture: The admixture shall comply with ASTM C494, Type A, and not contain more chloride ions that are present in municipal drinking water.

1) Eucon WR-75 by Euclid Chemical Co.

2) Pozzolith 200N by Master Builders.

3) Plastocrete 160 by Sika Chemical Corp.

b. Water Reducing, Retarding Admixture: The admixture shall comply with ASTM C494, Type D, and not contain more chloride ions that are present in municipal drinking water.

1) Eucon Retarder-75 by Euclid Chemical Co.

2) Pozzolith 100XR by Master Builders.

3) Plastiment by Sika Chemical Corp.

c. High Range Reducing Admixture (Superplasticizer): The admixture shall comply with ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.

1) Eucon 37 by Euclid Chemical Co.

2) Sikament by Sika Chemical Corp.

d. Non-Chloride Accelerator: The admixture shall comply with ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water.

1) Accelguard 80 by Euclid Chemical Co.

2) Darex Set Accelerator by W.R. Grace.

3. Air Entraining Admixture: Complying with ASTM C260.

4. Calcium Chloride: Calcium chloride or admixture containing more than 0.1 percent chloride ions are not allowed.

B. Certification: Written compliance to above-mentioned requirements and the chloride ion content will be required from the admixture manufacturer (include admixtures) before mix design review by the A/E.

2.3 PROPORTIONING

A. Comply with Chapter 3 of ACI 301 and the following:

1. Strength: Normal weight concrete - see drawings.

a. Concrete slabs, designated as "Concrete Pavement": 28-day compressive strength not less than 4,000 psi and a flexural strength (modulus of rupture)

of not less than 650 psi when tested according to "Method of Test for Flexural Strength of concrete (using simple beam with third point loading)", ASTM C78. Include curb or curb and gutters.

2. Durability:

   a. Pumped Concrete:

      1) Testing shall be completed at the final discharge location after pumping.

      2) Testing shall be completed at the truck before pumping.

      3) Samples shall include samples for both slump and strength tests.

      4) Adding of water to transit mixers/agitators.

         a) Contractor shall maintain a maximum time limit of 90 minutes on the introduction of water into the cement.

         b) Only 1 addition of water on the site to bring the mix to the producer's mix slump criteria is allowed.

   b. Design Mixes:

      1) Design mixes for concrete intended to be placed as-is from the truck shall be designed as such.

      2) Design mixes for concrete intended to be pumped shall be made on one of the following bases:

         a) The mix shall be designed as a truly plastic mix by proper proportioning. See ACI 304.2R – Placing Concrete By Pumping Methods for guidelines for a pumpable plastic workable mix. Trial batches shall be made, and without a device to test pumping ability, results of field trials shall be used.

         b) Water shall not be added at the pump. One addition of water at the truck to meet the design slump (at the truck) is allowed.

         c) A super plasticizer may be used.

   c. Concrete slabs placed at temperatures below 40 degrees F. shall contain the "Non-Chloride Accelerator".

   d. Concrete required to be air entraining shall contain the "Air Entraining Admixture", and air content shall comply with table 3.4.1 of ACI 301.

   e. Pumped concrete and concrete with a water/cement ratio less than 0.50 shall contain the "High Range Water Reducing Admixture".

   f. The "Water Reducing", Type A, or "Water Reducing and Retarding", Type D admixtures complying with ASTM C494 may be used at the option of the Contractor.

   g. Concrete containing the "High Range Water Reducing Admixture" (superplasticizer) shall have a maximum slump of 8 inches unless otherwise directed by the A/E. The concrete shall be proportioned for a slump of 2 to 3 inches, be verified, then the high range water reducing admixture added to increase the slump to the approved level.

h. All other concrete shall be proportioned to have a maximum slump of 4 inches.

3. Normal weight concrete shall be air-entrained. Amount of air-entraining shall be according to Table 3.4.1.

4. Requirements for Other Concrete: The requirements of Paragraph 2.03 D(1).

2.4 FORM WORK

A. Comply with Chapter 4 of ACI 301 and the following:

1. Earth cuts shall not be used as forms for vertical surfaces. Natural rock formations maintaining a stable vertical cut may be used as side forms. Comply with OSHA's "Trench Safety Act".

2. Design and Installation of Formwork: Form ties that leave through holes in the concrete are not allowed.

3. Removal Strength:

a. Wall forms and column forms may be removed 12 hours after pouring.

b. Slabs supported by precast joists may have forms removed as follows:

1) Joist spacing 4'-6" or less, 24 hrs.

2) Joist spacing between 4'-6" and 6'-8", 48 hrs.

3) Joist spacing between 6'-8" and 8'-8", 72 hrs.

c. Beams and other slabs shall not have forms removed until the concrete has achieved 75 percent of its design strength. Beams shall be reshored immediately upon removal of forms.

d. In addition to the above, flat slab forms and stair slab forms shall not be removed for 5 days. Upon removal of forms, reshores shall be placed and remain in place until concrete is 14 days old.

2.5 REINFORCEMENT

A. Comply with Chapter 5 of ACI 301 and Section 032000 – Concrete Reinforcement.

2.6 FIBER REINFORCEMENT

A. Comply for use in plain concrete as defined in ACI 318.1. and Section 032000 - Concrete Reinforcement.

2.7 JOINTS AND EMBEDDED ITEM

A. Comply with Chapter 6 of ACI 301 and the following:

1. 1. Expansion Joints:

a. Premolded joint fillers shall be preformed bituminous type, ASTM

D1751 for joints without sealant.

b. Premolded expansion joint fillers for pavements, for joints with

sealant and where indicated shall be non-extruding and resilient

type of ASTM D1752, compatible with urethane joint sealant

compounds.

2. Waterstops:

a. Waterstops and fittings shall be manufactured from PVC. The waterstops shall be as manufactured by Greenstreak or accepted equivalent.

b. For construction joints, 4 inch serrated typed with Centerbulb, RS 316-4 or RB316-4 shall be used.

c. For expansion joints, 6-inch serrated type with Centerbulb, RB38T6 or RSB386 shall be used.

d. Make splices using splicing unions according to manufacturer's instructions. Make waterstop intersections using factory molded fittings.

e. Provide #14 tie wire at 2'-0" center to center embedded in base pour for waterstop support.

2.8 PRODUCTION OF CONCRETE

A. Comply with Chapter 7 of ACI 301 and following:

1. Ready-Mixed Concrete:

a. Provide copies of each delivery ticket to the A/E. Include mix designation on delivery ticket.

b. Do not place concrete over 90 minutes old from the time it was batched.

2. Weather Conditions:

a. Where the relative humidity is less than the corresponding concrete temperature as placed, or intended to be placed, as indicated in the following Table, the Contractor shall follow the recommendations of ACI 305R, "Hot Weather Concreting".

Concrete Temperature (F)	Minimum Relative Humidity
100	80
95	70
90	60
85	50
80	40
75	30

b. The above Table is based upon a wind speed of 10 mph. For ambient wind speeds more than 10 mph, the Contractor shall follow the recommendations of Fig.2.1.5 of ACI 305R if the relationships of air temperature, wind velocity, relative humidity, and concrete temperature indicate a rate of evaporation more than 0.2 pounds per sq.ft. per hour.

c. Concrete having a temperature more than 100 degrees F. shall not be placed.

d. The requirements of Paragraph 7.6.1.2 of ACI 301 (cooling of concrete ingredients are not waived).

2.9 PLACING

A. Comply with Chapter 8 of ACI 301 and the following:

1. Protection: When the temperature of the concrete exceeds the minimum relative humidity relationship specified in Paragraph "Production of Concrete", the requirements of Paragraph "Production of Concrete" shall control.

2.10 REPAIR OF SURFACE DEFECTS

A. Comply with Chapter 9 of ACI 301 and the following:

1. 1. With prior approval of the A/E, as to method and procedure, repair
2. defective areas according to ACI 301, Chapter 9, except that the bonding
3. compound Euco Weld by the Euclid Chemical Company or Weldcrete by
4. the Larsen Company must be used.
5. 2. Defects designated as "structural" by the A/E shall be repaired with prior
6. approval of the A/E, as to method and procedure, using the epoxy
7. adhesive epoxy mortar as furnished by the Euclid Chemical Company or
8. Sika Chemical Corp.

2.11 FINISHING OF FORMED SURFACES

A. Comply with Chapter 10 of ACI 301 and the following:

1. 1. Finishes:

a. All concrete shall be "rough form finish" according to Paragraph 10.2 of ACI 301, except concrete that will be exposed to view shall be "broom finish" or “rock salt finish” and scored per the Plans. Pool deck to be non-slip finish per Section 030500 Pool Deck Finish. Contractor to provide finishing methodologies for review by Landscape Architect.

2.12 SLABS

B. Comply with Chapter 11 of ACI 301 and the following:

1. 1. Finishes: Finishes shall be according to Paragraph 11.8 of ACI 301
2. except as specified.
3. 2. Maximum allowable tolerances for floor slabs not receiving ceramic or
4. quarry tile shall be 1/8" in a 10 foot radius.
5. 3. Exterior slabs receiving tile, pavers, or similar covering shall be troweled
6. finish.

2.13 CURING AND PROTECTION

A. Comply with Chapter 12 of ACI 301 and the following:

1. Preservation of moisture according to Paragraph 12.2 of ACI 301.

2. Curing and Sealing Compound: Super Floor Coat or Super Pliocure by the Euclid Chemical Company or Masterseal 66 by Master Builders. The compound shall comply with ASTM C309, Type 1 or Type 1D, 30 percent solids content minimum, and have test data from an independent laboratory indicating a maximum moisture loss of 0.030 grams per sq.cm. when applied at a coverage rate of 300 sq.ft. per gallon. Manufacturers certification required.

3. Curing and Hardening Compound: "Eucosil" by the Euclid Chemical Company or "Curetox" by Toch Brothers. The compound shall be sodium silicate type.

4. Apply compounds according to manufacturer's directions.

5. Slabs receiving carpet or are of exposed concrete in the finished structure shall receive the "Curing and Sealing Compound". Excludeexterior walks and pavements.

6. Slabs receiving resilient tile or cementitious or other toppings are to receive the "Curing and Hardening Compound".

7. Verify the compatibility of the compound with the applied coverings or toppings.

8. Submit manufacturer's data.

9. Application of Curing and Sealing and Curing and Hardening Compound: Apply compound to concrete floors and slabs according to manufacturer's directions and as follows:

a. After fresh placed concrete surface has been finished and will not be marred by application, uniformly apply undiluted compound by spray, brush or squeegee without allowing compound to collect in low spots.

b. Keep traffic off surface for 24 hours or until surface is completely dry.

c. Within 1 week of a date set by the A/E, thoroughly clean and wash exposed concrete interior floors, then apply a second uniformly applied coat of the specified Curing and Sealing Compound without allowing compound to collect in low spots. Keep traffic off surface for 24-hours following the second coat, or until surface is completely dry. Exclude walks, pavements, and exterior slabs.

B. Temperature, Wind, and Humidity: The requirements of "Production of Concrete" shall decide the conditions and precautions for hot weather concreting.

2.14 TESTING

A. Comply with Chapter 16 of ACI 301, Section 03312 - Concrete Testing, and the following:

1. Testing Agencies: The cost of testing services unless specified otherwise, will be as follows:

2. Services described in Paragraphs 16.3.1, 16.3.2, and 16.3.3 of ACI 301 (review or check test Contractor's materials and mix design, secure and test production samples at plants or stock piles) will be paid by the Contractor, as required by the A/E.

3. Services described in Paragraphs 16.3.4, 16.3.5, and 16.3.6 of ACI 301 (strength, slump, and temperature tests of concrete) will be paid by the Contractor.

4. If air entrained concrete is specified, tests according to Paragraphs 16.3.5 and 16.3.6 of ACI 301 (air content will be paid by Contractor.

5. Services described in Paragraph 16.5 of ACI 301, additional testing and inspection because of changes proposed by Contractor, additional testing because of failure to meet specifications shall be paid by Contractor.

B. Testing Services:

1. For strength test of concrete, mold, cure, and test 5 specimens. Test 1 at 3 days, 1 at 7 days, and 3 at 28 days.

2. Make 1 strength test for each 50 cubic yards or fraction thereof placed in any 1 day.

2.15 EVALUATION AND ACCEPTANCE OF CONCRETE

A. Comply with Chapter 17 of ACI 301.

2.16 ACCEPTANCE OF STRUCTURE

A. Comply with Chapter 18 of ACI 301.

PART 3 - NOT USED.

END OF SECTION 03300

SECTION 033713 –SHOTCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Shotcrete Materials
2. Admixtures
3. Miscellaneous Materials
4. Proportioning and Design of Mixes

B. Related Sections:

1. SECTION 030000 - CONCRETE

C. References:

1. Project Document: Geotechnical Soils Report
2. ACI 506.2 – SPECIFICATION FOR SHOTCRETE
3. ASTM C33 – STANDARD SPECIFICATION FOR CONCRETE AGGREGATES
4. ASTM C94 – STANDARD SPECIFICATION FOR READY-MIX CONCRETE
5. ASTM C150 – STANDARD SPECIFICATION FOR PORTLAND CEMENT
6. ASTM C260 – STANDARD SPECIFICATION FOR AIR-ENTRAINING ADMIXTURES FOR CONCRETE
7. ASTM C330 – STANDARD SPECIFICATION FOR LIGHTWEIGHT AGGREGATES FOR STRUCTURAL CONCRETE
8. ASTM C494 – STANDARD SPECIFICATION FOR CHEMICAL ADMIXTURES FOR CONCRETE
9. ASTM C685 – STANDARD SPECIFICATION FOR CONCRETE MADE BY VOLUMETRIC BATCHING AND CONTINUOUS MIXING

1.2 SUBMITTALS FOR REVIEW

A. SECTION 013300 – SUBMITTAL PROCEDURES

B. Product Data: Submit Manufacturer’s product literature for each type of admixture, patching compound, supports, backing materials, etc used in or on the shotcrete material.

C. Concrete Mix Design: Submit Shotcrete Mix Design for each shotcrete mix type to be used. Include the following information:

1. Mix Identification Designation
2. Statement of Intended Use for Mix
3. Mix Proportions, including Admixtures
4. Wet and Dry Unit Weight
5. Entrained Air Content
6. Design Slump

7. Design Compressive Strength

8. Water/Cementitious Material Ratio

9. Aggregate Source

10. Admixtures

11. Strength Qualification Data:

    a. Submit required average strength qualification data and documentation per ACI 301 4.2.3.

    b. If trial batches are used to qualify average strength, mix design shall be prepared by an independent testing laboratory and shall achieve average compressive strength a minimum of 1,200 psi (8.25 MPa) greater than specified strength with slump within 1 inch (25mm) of maximum permitted and air content within 0.05% of maximum allowable.

    c. If field test data is used to qualify average strength, submit separate qualification data for each production facility that will supply concrete to the project, include copies of concrete testing agency's reports from which the data was compiled.

D. Test Reports: Provide Test Reports of control tests, special tests, and core tests prepared and distributed by an independent testing laboratory.

E. Shop Drawings: For Artificial Rockwork applications, provide shop drawings showing the following information:

1. Indicate formwork, shaped earthwork, dimensions and thickness, tolerances, contours, reinforcement, accessories, and structural steel for secondary support.

1.3 QUALIFICATIONS

A. Installer Experience: Company specializing in performing the work of this section with minimum of five (5) years' experience and approved by the Engineer/Architect.

B. Nozzlemen shall have current certification in accordance with ACI 506.3R for type of shotcrete required.

1.4 TEST PANELS AND MOCKUPS

A. Test Panels shall be prepared by each nozzleman and tested for all applications of shotcrete per the following requirements:

1. Make three (3) test panels at least 30 by 30 inches (750 by 750mm) for each mix being considered and each surface and shooting positions encountered on the Project.

    a. For example: panels representing vertical walls shall be shot with the panels in a vertical position. Panels representing horizontal surfaces shall be shot with the panels in a horizontal position.

    b. Comply with applicable provisions of ASTM C1140.

    c. Fabricate test panels to the same thickness as the structure to be shot, but not less than 6 inches (150mm).

2. Provide the same reinforcement in the test panel as used in the structure, placed in at least half the panel to check for proper shotcrete placement around reinforcing steel. Panels may be cut to visually inspect proper placement.

3. Each application crew performing shotcrete Work shall be required to make test panels.

4. Take one (1) 3-inch (75mm) diameter core specimens from each panel for testing. Test specimens for strength in accordance with ASTM C42. The average compressive strength of the cores taken from the test panels must equal or exceed 85 percent of specified compressive strength.

B. Mock-up for applications for Special Architectural Treatment:

1. Construct and erect a field sample for each type of shotcrete structure receiving a special architectural treatment or finish.

2. Sample panel sized sufficiently, typically 4 feet (1.2m) high by 8 feet (2.4m) in length, to indicate all aspects of the special treatment or finish.

3. Provide same method of construction and reinforcement in mock-ups as used in the structure. Apply finish treatment to mock-up.

4. Modify final finished treatment, or construct additional mock-ups, as required until acceptable to the Architect/Landscape Architect. Accepted sample panel is considered basis of quality for the finished Work.

5. Locate panels where directed by the Architect/Engineer. Mock-up may not remain as part of the Work and must be removed at the end of the Project.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified:

1. ACI 301 and 506.2.

2. Concrete Reinforcing Steel Institute (CRSI) – Manual for Standard Practice.

B. Testing Service: Engage an independent testing laboratory acceptable to the Architect/Engineer to perform material evaluation tests.

1. Materials and installed Work may require testing and retesting at any time during the progress of the Work. Testing and retesting of rejected materials shall be done at the Contractor's expense.

C. Shotcrete Testing: Test shotcrete for compressive and flexural strength using the following methods:

1. Prepare test panels and take core samples for testing per the requirements outlined in this section.

2. If test panels were not prepared during construction the Contractor shall take samples for the In-Place Shotcrete:

a. Cut a minimum 3-inch (75mm) nominal diameter core from the structure and test in accordance with ASTM C42.

b. Do not cut into Steel Reinforcement.

c. Repair the core hole in the structure.

3. Additional samples from In-Place Shotcrete for Pool shells shall be taken only if directed by the Engineer, and only if any of the test samples from the test panels fail.

4. Strength Evaluation of In-Place core samples:

a. If In-Place core samples are taken for testing the mean compressive strength of the core sample must equal or exceed the specified compressive strength, with no individual core less than 85 percent of the specified compressive strength.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Ensure materials and ambient air temperatures are a minimum 50 °F (10 °C) prior to, during, and seven (7) days after the completion of the Work.

B. During freezing or near freezing weather provided equipment and cover to maintain a minimum 50 °F (10 °C) and to protect the Work completed or Work in progress.

C. Suspend shotcrete operation during high winds, rainy weather, or near freezing temperatures, when the Work cannot be protected.

PART 2 - PRODUCTS

2.1 SHOTCRETE MATERIALS

A. Portland Cement: ASTM C150, Type II with C3A ≤ 5% or Type V, provided from one (1) source.

B. Fly Ash: ASTM C618, Type C or F.

C. Normal Weight Aggregates: ASTM C33 and as herein specified. Provide aggregates from a single source for exposed concrete.

1. Located aggregates not complying with ASTM C33 but that can be shown by special test or actual service to produce shotcrete of adequate strength and durability may be used when acceptable to the Engineer.

D. Lightweight Aggregates: ASTM C330.

E. Mix Water:

1. Clean potable water conforming to ASTM C94.

2. Free from deleterious amounts of acids, alkalis, salts, and organic matter.

F. Pre-Bagged Shotcrete Materials: Proprietary pre-bagged shotcrete materials may be used when proof of satisfactory applications is acceptable to the Engineer.

2.2 ADMIXTURES

A. General: Provide Admixtures for shotcrete that contain no more than 0.1 percent chloride ions.

B. Air-Entraining Admixture: ASTM C260, certified by the Manufacturer to be compatible with all other required admixtures.

1. Acceptable Products – Subject to compliance with all requirements:

a. Air-Tite by Cormix

b. Air-Mix or Perma-Air by Euclid Chemical Company

c. Darex AEA or Daravair by W R Grace

d. MB-VR or Micro-Air by Master Builders Incorporated

e. Sealtight AEA by W R Meadows, Incorporated

f. SIKA AER by SIKA Corporation

C. Water-Reducing Admixture: ASTM C494, Type A.

1. Acceptable Products – Subject to compliance with requirements:

a. PSI N by Cormix

b. Chemtard by ChemMasters Corporation

c. Eucon WR-75 by Euclid Chemical Company

d. WRDA by W R Grace

e. Pozzolith Normal or Polyheed by Master Builders Incorporated

f. Prokrete-N by Protex Industries, Incorporated

g. Plastocrete 161 by SIKA Corporation

D. High-Range Water Reducing Admixture (Super Plasticizer) ASTM C494, Type F or G.

1. Acceptable Products – Subject to compliance with requirements:

a. Super P by Anit-Hydro Company

b. PSI Super by Cormix

c. Eucon 37 by Euclid Chemical Company

d. WRDA 19 or Daracem by W R Grace

e. Rheobuild by Master Builders Incorporated

f. PSP Superplasticizer by Protex Industries Incorporated

g. Sikament by SIKA Corporation

E. Water Reducing, Retarding Admixture: ASTM C494 Type D.

1. Acceptable Products – Subject to compliance with requirements:

a. PSI-R Plus by Cormix

b. Eucon Retarder 75 by Euclid Chemical Company

c. Daratard-17 by W R Grace

d. Pozzolith-R by Master Builders Incorporated

e. Protard by Protex Industries, Incorporated

f. Plastiment by SIKA Corporation

2.3 MISCELLANEOUS MATERIALS

A. Surfaces to be finished with tile and/or plaster pool finishes shall not be cured using sealers or curing compounds unless approved by the Engineer and Manufacturers of the finish material and curing compound.

B. Surfaces where sealers and curing compounds are used will need to be cleaned to remove any such compound from the surface prior to applying finishes.

C. Curing Compound: Liquid membrane-forming curing compound complying with ASTM C309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. m when applied at 200 sq ft/gal (5 sq. m/L).

1. Acceptable Products – Subject to compliance with requirements:

a. A-H 3-Way Sealer by Anti-Hydro Waterproofing Company

b. Spartan-Cote by the Burke Company

c. Conspec #1 by Conspec Marketing and Maufacturing Company, Incorporated

d. Hardtop by Cormix

e. Day-Chem Cure and Seal by Dayton Superior

f. Eucocure by Euclid Chemical Company

g. Horn Clear Seal by A C Horn Incorporated

h. L & M Cure by L & M Construction Chemicals

i. Masterkure CR (Clear) by Master Builders Incorporated

j. CS-309 by W R Meadows, Incorporated

k. LR-151 by Prokrete Industries

l. Kure-N-Seal by Sonneborn-Rexnord

m. Stantop CS9 by Stonhard, Incorporated

D. Bonding Compound: Polyvinyl Acetate or Acrylic Base.

1. Acceptable Polyvinyl Acetate (Interior Only) Products:

a. Superior Concrete Bonder by Dayton Superior

b. Euco Weld by Euclid Chemical Company

c. Weldcrete by Larson Products Corporation

2. Acceptable Acrylic or Styrene Butadiene Products:

a. Acrylic Bondcrete by The Burke Company

b. Day-Chem Ad Bond by Dayton Superior

c. SBR Latex by Euclid Chemical Company

d. Daraweld C by W R Grace

e. Hornweld by A C Horn Incorporated

f. Everbond by L & M Construction Chemicals

g. Acryl-Set by Master Builders Incorporated

h. Intralock by W R Meadows Incorporated

i. Sonocrete by Sonnoborn-Rexnord

j. Stanlock LB2 by Stonhard, Incorporated

E. Epoxy Adhesive: ASTM C881, two-component material suitable for use on dry or damp surfaces. Provide material “Type”, “Grade”, and “Class” to suit project requirements.

1. Acceptable Products – Subject to compliance with requirements:

a. Burke Epoxy M. V. by The Burke Company

b. Spec-Bond 100 Conspec Marketing and Manufacturing Company, Incorporated

c. Euco Epoxy 452 or 620 by Euclid Chemical Company

d. Thiopoxy by W R Grace

e. Epoxtite Binder 2390 by A C Horn Incorporated

f. Conressive 1001 by Master Builders Incorporated

g. Sikadur 32 Hi-Mod by SIKA Corporation

2.4 PROPORTIONING AND DESIGN OF MIXES

A. General: Prepare Mix Designs for each type and strength of shotcrete by either laboratory trial batch or field experience methods as specified in ACI 301.

1. If trail batch method is used

a. Use an independent testing facility acceptable to the Architect/Engineer for preparing and reporting proposed mix designs.

2. The testing facility shall not be the same as used for field quality control testing.

3. Limit the use of fly ash to a maximum of 25 percent of cement content by weight.

4. Submit written reports to Engineer of each proposed mix for each class of shotcrete at least 15 days prior to the start of the Work.

5. Do not begin shotcrete production until the Engineer has reviewed the proposed mix designs to be in accordance with the Contract Documents and Specifications.

B. Design Mixes to provide Normal Weight Shotcrete with the following properties, or as indicated on the Contract Documents and Schedules.

1. 5,000 psi (34.5 MPa) minimum 28-day compressive strength.

2. Air content, when using wet-mix process, of 6 to 8 percent in the pre-placed mix.

C. Adjustment to Shotcrete Mixes:

1. The Contractor may request mix design adjustments when characteristics of the material, job conditions, weather, test results, or other circumstances warrant at no additional cost to the City and as acceptable by the Architect/Engineer.

2. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Architect/Engineer before use.

D. Admixtures:

1. Use water-reducing admixture or high range water-reducing admixture (super plasticizer) in shotcrete as required for placement and workability.

a. Use air-entraining admixture in exterior exposed shotcrete, unless otherwise indicated.

b. Use Admixtures for water-reducing and set control in strict compliance with the Manufacturer's directions.

E. Develop mix design to give good compaction and low percentage of rebound; stiff enough not to sag when placed vertically.

F. Maintain quality control records during production of shotcrete; records must be made available at all times during construction and submitted at the end of construction.

2.5 SHOTCRETE EQUIPMENT

A. Mixing Equipment:

1. Capable of mixing shotcrete materials in sufficient quantities to maintain continuous placement and thoroughly coating aggregate with cement particles.

2. Mixer shall be self-cleaning (i.e. capable of discharging all mixed material without any "carry over" from one batched to the next) and be thoroughly cleaned at least once a day to prevent accumulations of batched material.

B. Air Supply:

1. Provide uniform, steady supply of clean, dry air to maintain constant nozzle velocity while operating blow pipe for cleaning away rebound.

2. Provide air pressure gauge at outlet of the gun to continuously monitor air pressure at the nozzle in accordance with ACI 506, Table 401c.

C. Wet-Mix Delivery Equipment:

1. Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

D. Dry-Mix Delivery Equipment:

1. Capable of discharging aggregate-cement mixture into delivery hose under close control and maintaining continuous stream of uniformly mixes material at required velocity to discharge nozzle.

2. Equip discharge nozzle with manually operated water-injection system for directing even distribution of water to aggregate-cement mixture.

3. Provide water supply with uniform pressure at discharge nozzle sufficiently greater than operating air pressure to ensure complete mixing with the aggregate-cement mixture.

4. Provide water pump to system if line water pressure is inadequate.

PART 3 - EXECUTION

3.1 BATCHING AND MIXING

A. General:

1. Control mix proportion by weight batching, or by volume batching meeting requirements of ASTM C685.

2. If permitted by the Engineer, other batching procedures may be used provided a minimum of one (1) weight batching check is made every 8 hours or for every 50-cu. yd (38 cu. m) passing through the nozzle to ensure that specified mixture design is achieved.

3. Use batching and mixing equipment capable of proportioning and mixing ingredients (except water in the case of dry-mix equipment) at a rate that provides adequate production and with an accuracy that ensures uniformity of batches.

4. Use weighing equipment capable of batching with accuracy specified in ASTM C94.

5. Use volumetric equipment capable of batching with accuracy specified in ASTM C685. In volume batching, adjust fine aggregate volume for bulking. Test fine aggregate moisture content at least once daily to determine extent of bulking.

B. Ready-Mix Materials:

1. Comply with ASTM C94, except it may be delivered to shotcrete equipment in the dry state if equipment is capable of adding water and mixing it satisfactorily with dry ingredients. Or comply with ASTM C685 when ingredients are delivered dry and proportioned and mixed at site.

3.2 SURFACE PREPARATION

A. Existing Concrete or Masonry

1. Remove unsound material before applying shotcrete.

2. Chip or scarify areas to be repaired to extent necessary to provide a sound substrate.

3. Taper edges to leave no square shoulders at perimeter of cavity. Remove loose material from areas receiving shotcrete.

4. Sandblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and provide roughened surface for proper bonding of shotcrete.

5. Wet surfaces until damp but without visible free water.

B. Earth:

1. Compact and trim to line and grade before placing shotcrete.

2. Do not place shotcrete on frozen surfaces.

3. Dampen surfaces just prior to shotcrete placement.

C. Rock:

1. Clean rock surfaces of loose material, mud, and other foreign matter that will prevent bond of shotcrete.

3.3 INSPECTION

A. Refer to overall Project Specification for inspection requirements.

B. Verify that conditions are acceptable and are ready to receive Work.

C. Verify fabricated forms are true to line and dimension, adequately braced against vibration during placement, constructed to permit escape of trapped air during gunning operations, and constructed to minimize rebound during gunning operations.

D. Verify pipes, conduits, box outs, and other penetrations required by other trades are installed and properly anchored and secured prior to applying shotcrete.

E. Verify that all grounding connections are installed prior to placing concrete. All Steel Reinforcement must be grounded in accordance with the National Electrical Code (NFPA 70).

3.4 ALIGNMENT

A. Provide alignment wire to establish thickness and plane of required surfaces.

B. Install alignment wire at corners and offsets not established by forms.

C. Tighten alignment wire true to line. Position adjustment devices to permit additional tightening.

3.5 JOINTS

A. Joints are not allowed in Pool shells. Pool shells are intended to be poured as a continuous and homogeneous shell. Prior approval must be obtained from the Engineer before installing Joints.

B. Construction Joints

1. Locate and install construction joints as indicated on the Contract Documents or, if not indicated, submit desired location that does not impair strength and appearance of the structure to the Engineer of Record.

2. Place construction joints perpendicular to main reinforcement. Continue

reinforcement across construction joints where not otherwise shown.

3. Fill and seal joints with appropriate materials to provide a water tight joint.

C. Contraction Joints:

1. Construct contraction joints in slabs-on-ground to form panels of patterns as shown in the Contract Documents.

2. Use saw cuts 1/8 inch (3mm) by 1/3 slab depth or inserts 1/4 inch (6mm) wide by 1/3 of shotcrete depth, where not otherwise indicated.

3. Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strip into fresh shotcrete until top surface of strip is flush with shotcrete surface. Tool edges round on each side of insert. After shotcrete has cured, remove inserts and clean groove of loose debris.

4. If joint pattern in not shown, provide joints not exceeding 15 feet (4.5m) in both directions and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

5. Fill and seal joints with appropriate materials to provide a water tight joint.

3.6 INSTALLATION OF EMBEDDED ITEMS

A. General:

1. Set and build into Work anchorage devices and other embedded items required for other work that is attached to or supported by shotcrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Edge Forms and Screed Strips for Slabs:

1. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting-type screeds.

3.7 SHOTCRETE APPLICATION

A. General: Comply with ACI 304 and as herein specified.

B. Place concrete on properly prepared undisturbed subgrade materials or engineered fill. Refer to the Geotechnical Soils Report for recommendations.

C. Moisten wood forms immediately before placing shotcrete where form coatings are not used.

D. Apply temporary protective covering to guard against splattering during placement.

E. Direct outlet nozzle perpendicular to surface to ensure maximum compaction with minimum rebound.

F. Deposit shotcrete continuously or in layers of such thickness that shotcrete is not placed on material that has hardened sufficiently to cause the formation of seams or planes of weakness.

G. Do not permit applied shotcrete to sag, slough, or displace.

H. Placing Shotcrete Slabs:

1. Deposit and consolidate shotcrete slabs in a continuous operation until the placing of a panel or section is complete.

2. Consolidate shotcrete during placing operations so that shotcrete is thoroughly

worked around reinforcement and other embedded items and into corners.

3. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hallows. Do not Disturb slab surface prior to beginning finishing operations.

4. Maintain reinforcing in proper position and with proper coverage during shotcrete placement operations.

I. Cold-Weather Placing:

1. Protect shotcrete Work from physical damage or reduced strength by frost, freezing, or low temperatures in compliance with ACI 306 and as specified.

2. When ambient air temperatures have fallen to or is expected to fall below 40

°F (4.4 °C), uniformly heat water and aggregates before mixing to obtain a shotcrete mix temperature of not less than 50 °F (10 °C) and not more than 80 °F (26.7 °C) at point of placement.

3. Do not use frozen materials or materials containing ice or snow. Do not place shotcrete on frozen subgrade or on subgrade containing frozen materials.

4. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerator unless accepted in the mix designs.

J. Hot-Weather Placing:

1. When hot-weather conditions exist that would seriously impair quality and strength of shotcrete, place in compliance with ACI 305 and as specified.

2. Cool ingredients before mixing to maintain shotcrete temperature at time of placement below 90 °F (32 °C). Mixing water may be chilled or chopped ice may be used to control temperature provided that water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool shotcrete is the Contractor's option.

3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature does not exceed the ambient air temperature immediately before placement.

4. Fog spray forms, reinforcing steel, and subgrade just before shotcrete is placed.

5. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

3.8 SURFACE FINISHES

A. Unexposed Surfaces: Provide natural gun finish unless otherwise indicated.

B. Exposed Surfaces:

1. Screed smooth areas on exposed face of structures to original plane, then lightly float and trowel for continuous, smooth finish. Remove alignment wires or other alignment control devices.

2. Flash Coat: After screeding, apply a 1/8 to 1/4-inch (3 to 6mm) coat of shotcrete using fine screened sand. Keep application nozzle at a distance greater than required for normal shotcreting.

3. Provide wood float finish after application of flash coat.

3.9 CURING AND PROTECTION

A. Cure surfaces in accordance with ACI 308.

B. General: Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.

C. Start initial curing as soon as free water has disappeared from shotcrete surface after placing and finishing using the following approved methods.

1. Horizontal Surfaces

a. Wet Curing by Ponding: Maintain 100 percent coverage of water over floor slab areas maximum 1/4 inch (6mm) deep.

b. Wet Curing by Spraying: Spray water over floor slab area as required to prevent surface drying.

2. Vertical Surfaces

a. Wet Curing with Burlap Sacks: Place burlap sacks over the entire surface, wet sacks as required to prevent surface drying.

b. Wet Curing by Spraying: Spray water over floor slab area as required to prevent surface drying.

D. Continue curing placed shotcrete and maintain surface wetting for at least seven

(7) days using the method described in this section or as approved by the Engineer.

E. Curing compounds may not be used, unless specifically approved by the Engineer prior to application.

3.10 REMOVAL OF FORMS

A. Forms not supporting weight of shotcrete may be removed after 24 hours if shotcrete has cured at temperatures greater than 50 °F (10 °C) and provided shotcrete is sufficiently hard that it will not be damaged by form removal operations and provided curing and protection operations are maintained.

B. Forms supporting weight of shotcrete may not be removed in less than 14 days and until shotcrete has attained design minimum compressive strength at 28-days. Determine potential compressive strength of In-Place shotcrete by testing field- cured specimens' representative of shotcrete location or members.

C. Form-facing material may be removed four (4) days after placement only if shores and other vertical supports have been arranged to permit removal without loosening or disturbing shores and supports.

3.11 REPAIR OF DEFECTS

A. Remove and replace shotcrete that lacks uniformity, or exhibits segregation, honeycomb, delamination, or contains dry patches, single voids in excess of 1/2 inch (12mm) in any direction or sand pockets.

B. Perform a sounding test to the applied material with a hammer for voids. Expose voids and replace with new shotcrete ensuring full bond with adjacent Work.

C. Remove over spray and rebound material that does not fall clear of Work; discard salvaged rebound.

END OF SECTION

SECTION 035300 - CONCRETE TOPPING

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:

1. 311000 – Site Clearing.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. A185-02 Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

1.3 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete Strength: Normal weight concrete - 3,000 psi at 28 days.

B. Welded Wire Mesh: According to ASTM A185, galvanized smooth wire 6 x 6 1.4/1.4.

PART 3 EXECUTION

3.1 INSTALLATION

A. Roughen substrate to insure bonding of topping.

B. Place concrete topping with wire mesh reinforcing and allow a minimum of 28 days curing time before proceeding with finished flooring materials.

C. Finish concrete surface with steel trowel, allowing not more than 1/8" variation in a 10'-0" radius.

1. Bring finished surface to a minimum 1/4" below level of existing flooring at door openings and other passageways.

D. Do not use sealing or curing agents of any kind.

E. Leave new concrete surface clean and free of dirt and other foreign matter ready to receive application of new troweled flooring materials.

F. Maintain substrate damp for the 24-hour period immediately preceding placement of topping.

G. Wet cure topping for 7 days with continuous spray/mist, burlap, or other accepted means.

END OF SECTION

SECTION 036000 – GROUT

PART 1 GENERAL

1.2 SUMMARY

A. Related Sections:
   1. 033000 - Cast-In-Place Concrete.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. C109-02 Test Method for Compressive Strength of Hydraulic Cement Mortars.
   2. C191-92 Test Method for Time of Setting Hydraulic Cement by Vicat Needle.
   3. C531-95 Test Methods for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, Monolithic Surfacing's, and Polymer Coatings.
   4. C579-96 Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts, Monolithic Surfacing's, and Polymer Coatings.
   5. C827-87 Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.

1.4 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

1.5 SUBMITTALS

A. Manufacturer's literature including specifications and printed installation instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. See materials as indicated in Drawings notes and details.

2.2 NONSHRINK CEMENTITIOUS GROUT

A. Exhibit no visible bleeding 2 hours after placement in a fluid consistency of 20 to 30 second flow through CRD C79 Flow Cone.

B. Grout shall show no shrinkage and a maximum of 4.0 percent expansion at any time before initial set and tested according to ASTM C827.

C. Grout shall show no shrinkage and a maximum of 0.2 percent expansion in the hardened state when tested according to CRD C588.

D. Compressive Strength: Minimum of 5,000 psi at 7 days and minimum strengths as listed below according to ASTM C109 modified.
   1. 24 Hours: 2,000 psi.
   2. 7 Days: 5,000 psi.

E. Grout shall show initial set time of not less than 60 minutes when tested according to ASTM C191.

F. Grout shall contain no metallic substances, water reducing agents, accelerators super plasticizers, or other materials.

G. Technical service shall be provided by the manufacturer of grout upon request of contractor.

H. Water shall be clean and free from injurious amounts of oil, alkalies, and other deleterious materials according to AASHTO T26.

2.3 EPOXY GROUT

A. Grout shall be flowable and a 100 percent solids system.

B. Grout shall show no shrinkage and a maximum of 4 percent expansion when tested according to ASTM C531 (Modified).

C. Compressive strength shall be determined by ASTM C579 attaining the minimum strengths listed below:
   1. 24 hours: 5,000 psi.
   2. 2 days: 8,000 psi.
   3. 7 days: 11,000 psi.

D. Peak exotherm temperature of a 2 inch diameter by 4 inch high cylinder of grout shall not exceed 95 degrees F. when tested at 75 degrees F. material and air temperatures.

E. Grout shall not exceed a coefficient of thermal expansion of 30 x 10-6 in/in/degrees F. when tested according to ASTM C531.

2.4 GROUT STORAGE

A. Grout components shall be delivered to the construction site in moisture proof bags. Bags shall be stored in a dry weatherproof area within a temperature range of 40 - 90 degrees F.

B. Remove damp or defective material from the site at no expense to the City.

C. Storage time of nonshrink cement grout mix shall be limited to 10 months.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Concrete surfaces shall be prepared for grouting by removing all oil, grease, laitance, and other foreign substances.

B. Roughen surfaces to receive grout by chipping or nail raking of plastic concrete to assure a good bond of grout to existing concrete. Clean thoroughly with water and soak surface for 24 hours before placing cement grout. Surfaces shall be kept completely dry for epoxy grout.

C. Metal surfaces of equipment bases to be epoxy grout shall be thoroughly cleaned to bright metal.

3.2 FORMS

A. Forms for fluid grout shall be built of materials with adequate strength to withstand the placement of grout.

B. Forms for nonshrink cement grout shall be tight against all surfaces and joints shall be sealed with tape. Form oil shall be used for easy form release.

C. Forms for grout shall be watertight with chamfer strips in place. Caulking shall be used on all joints. Forms for epoxy grout shall be lined with polyethylene or waxed for easy form release.

D. Forms shall be 4 to 6 inches higher than the base plate on one side of forms when using hydraulic head pressure for placing.

E. Provide air relief holes at least 1/4" in diameter at every recessed base plate corner.

3.3 MIXING

A. Grout shall be mixed according to manufacturers recommendations.

B. Nonshrink cement grout shall be added to water to obtain the desired consistency.

C. Epoxy Grout:
1. Components shall be conditioned to a temperature of between 70 and 85 degrees F. before use.
2. Epoxy hardener shall first be added to resin and thoroughly mixed for 2 to 3 minutes without whipping air into the mix.
3. Low speed mixer or hand stirring shall be used.
4. Mixed resin and hardener shall then be put into clean mortar mixer and the entire bag of aggregate added.
5. Epoxy grout component ratios shall not be altered and no solvents or thinners added to the mix.

D. Mix nonshrink cement grout between 3 and 5 minutes for uniform consistency.

E. Epoxy grout shall be mixed until aggregate is uniformly wetted.

F. Mortar mixer shall be used instead of a concrete mixer for mechanical mixing of grout.

G. Remixing of grout by adding more water or remixing of stiffening grout is not allowed.

3.4 REINFORCEMENT

A. Reinforcement and joints for epoxy grout shall be provided when and by methods recommended by the manufacturer of the grout.

3.5 PLACEMENT

A. Grout shall be rapidly placed continuously from one side of baseplate only in one direction.

B. Grout under base plates to fill all spaces and completely fill anchor bolt sleeves.

C. Hydraulic head grouting pressure shall be maintained by keeping the level of grout in the head box above the bottom of the base plate. Head box shall be filled to the maximum level and grout worked down to top of base plate.

D. Shims used for temporary leveling of equipment and base plates shall be removed after the grout has obtained sufficient strength to carry the baseplate loading. Voids left by the removal of shims shall be filled with a second placement of grout.

3.6 FINISHING

A. Alter cement grout has reached final set, it shall be trimmed back to the level as shown on drawings.

B. Top surfaces of epoxy grout may be finished by troweling with a steel trowel moistened with oil before set.

3.7 CURING

A. Nonshrink Cementitious Grout:
   1. Grout shall be cured according to manufacturer's specifications and recommendations.
   2. Forms shall remain in place for 24 hours.
   3. Temperature of base plates and supporting concrete shall be maintained between 40 and 90 degrees F. during grouting and for a minimum of 12 hours after placing.

B. Epoxy Grout:

1. Grout shall be cured according to manufacturer's specifications and recommendations.
2. Forms shall remain in place for a minimum of 24 hours after placing grout.
3. Temperature of base plate and supporting concrete shall be maintained between 40 and 80 degrees F. during grouting and for a minimum of 24 hours after placing.

3.8 TESTING

A. Contractor shall be responsible for preparing, storing, curing, and transporting the test samples to the laboratory for testing.

B. Grout shall develop required compressive strength according to ASTM C109 (modified) for packaged grouts and ASTM C579 for epoxy grout.

C. Three test cubes shall be made for each day of grouting. Tests shall be made of one cube at the following intervals:
1. Cement Grout: 24 hours, 7 days, and 28 days.
2. Epoxy Grout: 24 hours, 2 days, and 7 days.

D. Test reports shall be submitted to the A/E immediately after the result of each age test is available.

END OF SECTION

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 QUALITY ASSURANCE

A. Codes and Standards: Comply with governing codes and applicable provisions of the following:

1. National Concrete Masonry Association (NCMA), including "TEK Bulletins".
2. American Concrete Institute (ACI), including ACI 531, ACI 531R and ACI 531.1.
3. Portland Cement Association (PCA), "Concrete Masonry Handbook".

B. Fire Performance Characteristics: Where fire-resistance ratings are indicated for unit masonry work, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119 by a recognized testing and inspecting organization or by another means, as acceptable to authority having jurisdiction.

C. Field Construction Mock-Ups: Prior to installation of masonry work, erect sample wall representative of completed masonry work required for project with respect to qualities of appearance, materials and construction. Locate mock-ups during construction as standard for judging completed masonry work. Build mock-ups which are approximately 6' long by 4' high by full thickness. When directed, demolish mock-ups and remove from site.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory and other manufactured products, including certifications that each type complies with specified requirements.

1.04 JOB CONDITIONS

A. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

B. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.

D. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

E. Staining: Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over all surface.

F. Protect sills, ledges and projections from droppings of mortar.

G. Cold Weather Protection

1. Do not lay masonry units which are wet or frozen.

2. Remove all masonry determined to be damaged by freezing conditions.

3. No masonry work shall be performed when the air temperature is 38 deg. F. and falling.

PART 2 - PRODUCTS

2.01 MASONRY UNITS - GENERAL

A. Manufacturer: Obtain masonry units from one manufacturer, of uniform texture and color for each kind required, for each continuous area and visually related areas.

B. Masonry Unit Characteristics: Provide units complying with standards referenced and requirements indicated.

2.02 CONCRETE MASONRY UNITS (CMU)

A. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" (15-5/8" x 7-5/8" actual), unless otherwise indicated.

B. Special Shapes: Provide where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.

C. Hollow Load Bearing (HL) CMU: ASTM C 90 and as follows:

1. Grade N.

D. Weight Classification: Normal weight units unless otherwise indicated. (125 lbs. per cu. ft. or more, oven dry weight of concrete.)

E. Cure units by atmospheric drying for not less than 30 days before installation, to comply with ASTM C 90, Type II.

F. Exposed Faces: Provide manufacturer's standard color and texture, unless otherwise indicated.

1. Where special finishes are indicated, provide units with exposed faces of the following general description matching color and texture as selected by Architect from manufacturers standard color and texture.

a. Standard aggregate, ground finish.

b. Standard aggregate, split face finish.

G. Prefaced Concrete Block: Provide lightweight concrete units indicated below with manufacturer's standard smooth resinous tile facing complying with ASTM C744:

1. For units on which prefaced surfaces are molded, comply with the following requirements:

a. Hollow Loadbearing Block: ASTM C90, Grade N, Type I.

2. Size: Manufacturer's standard with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thickness indicated for units on which prefaced surfaces are molded; with 1/16" thick returns of facing to create 1/4" wide mortar joints with modular coursing.

I. Color and Pattern: Match Architect's sample.

J. Products: Subject to compliance with requirements, provide one of the following:

1. "Astra-Glaze"; Nabco Glazed Products.
2. "Spectra-Glaze II"; manufacturer approved by the Burns & Russell Co.

2.03 MORTAR 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 required mortar color.

B. Masonry Cement: ASTM C 91.

C. Hydrated Lime: ASTM C 207, Type S.

D. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4" use aggregate graded with 100% passing the No. 16 sieve.

E. Aggregate for Grout: ASTM C 404.

F. Water: Clean and potable.

2.04 MASONRY ACCESSORIES

A. Horizontal Joint Reinforcing and Ties for Masonry: Provide welded wire units prefabricated in straight lengths of not less than 10', with matching corner ("L") and intersecting ("T") units. Fabricate from cold-drawn steel wire complying with ASTM A 82, with deformed continuous side rods and plain cross rods, into units with widths of approximately 2" less than nominal width of walls and partitions as required to position side rods for full embedment in mortar with mortar coverage of not less than 5/8" on joint faces exposed to exterior and not less than 1/2" elsewhere. Provide the following type of joint reinforcing unless otherwise indicated.

1. Truss type with diagonal cross rods spaced not more than 16" o.c.

B. Number of Side Rods: Single pair for single wythe masonry.

C. Wire Sizes: Fabricate with 9-gage side and cross rods, unless otherwise indicated.

D. Wire Finish: Provide manufacturer's standard mill galvanized finish except as otherwise indicated.

E. For exterior walls hot-dip galvanized joint reinforcing after fabrication to comply with ASTM A 153, Class B-2 coating (1.5 oz. per sq. ft.).

F. Steel Strap Anchors: Provide straps, bars, bolts and rods fabricated from not less than 16 ga. sheet metal or 3/8" diameter rod stock, unless otherwise indicated.

G. Miscellaneous Masonry Accessories

1. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60 for bars No. 3 to No. 18.

2.05 MORTAR AND GROUT MIXES

A. Do not lower the freezing point of mortar by use of admixtures or anti-freeze agents.

B. Do not use calcium chloride in mortar or grout.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar required, unless otherwise indicated.

D. Limit cementitious materials in mortar to portland cement - lime.

E. Use Type N mortar for all interior masonry work.

F. Use Type S mortar for all exterior masonry work.

G. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Thickness: Build masonry construction to the full thickness shown, except, build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. Build chases and recesses as shown and as required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses unless otherwise noted.

C. Cut masonry units with motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible. Use dry cutting saws to cut concrete masonry units.

D. Do not wet concrete masonry units.

E. Pattern Bond: Lay exposed masonry in running bond vertical joint in each course centered on units in courses above and below except as otherwise noted.

F. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half size units at corners, jambs and wherever possible at other locations.

G. Lay-up walls plumb and with courses level, accurately spaced and coordinated with other work.

H. Stopping and Resuming Work: Rack back 1/2-masonry unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required to be wetted), and remove loose masonry units and mortar prior to laying fresh masonry.

I. Built-In Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.

J. Fill space between hollow metal frames and masonry solidly with mortar.

K. Where built-in items are to be embedded in cores of hollow masonry units, place a layer metal lath in the joint below and rod mortar or grout into core.

L. Fill CMU cores with grout 3 courses (24") under bearing plates, beams, lintels, posts and similar conditions unless otherwise indicated.

M. Non-Loadbearing Interior Partition Walls: Build full height of story to underside of solid structure above, unless otherwise indicated.

3.02 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units will full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout. For starting courses on footings where cells are not grouted, spread out full mortar bed including areas under cells.

B. Joints: Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not otherwise indicated, lay walls with 3/8" joints. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials. Tool all exposed

joints in masonry walls slightly concave using a jointer larger than joint thickness. Rake out mortar in preparation for application of caulking or sealants where shown.

C. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.03 HORIZONTAL JOINT REINFORCING

A. Provide continuous horizontal joint reinforcing as shown and specified. Full embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls and 1/2" at other locations. Lap reinforcement a minimum of 6". Do not bridge control and expansion joints with reinforcing, unless otherwise indicated. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by manufacturer for continuity at returns, offsets, pipe enclosures and other special conditions.

B. Space conditions horizontal reinforcing as follows:

1. For single wythe walls, space reinforcing at 16" o.c. vertically, unless otherwise indicated.
2. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcing placed in 2 horizontal joints approximately 8" apart, both immediately above lintels and below sills.

3. Extend reinforcing a minimum of 2'-0" beyond jambs of the opening, bridging control joints where provided.

3.04 ANCHORING MASONRY WORK

A. See Drawings.

3.05 LINTELS

A. Provide masonry lintels where shown and wherever openings of more than 1'-0" are shown without structural steel or other supporting lintels. Provide precast or formed in place lintels. Cure precast masonry before handling or installing. Temporarily support formed-in-place lintels.

B. Provide minimum bearing of 8" at each jamb, unless otherwise indicated.

3.06 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

C. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings. Comply with recommendations in NCMA TEK Bulletin No. 28.

END OF SECTION

SECTION 042030 - REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Provide each type of reinforced unit masonry work as indicated on drawings and in schedules and specified herein.

B. Requirements of Section 04 20 00, "Unit Masonry" apply to work of this section.

1.03 SUBMITTALS

A. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcement bars. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Refer to Section 04 20 00 for masonry materials and accessories not included in this section.

B. Reinforcement Bars: Provide deformed bars of Grade 60 complying with ASTM A 615.

C. Shop-fabricate reinforcement bars which are shown to be bent or hooked.

PART 3 - EXECUTION

3.1 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1" (whichever is greater).

C. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Architect. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

D. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 5/8" on exterior face of walls and 1/2" at other locations. Lap units not less than 6" at ends. Use prefabricated "L" and "T" units to provide continuity at corners and intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

3.2 INSTALLATION - GENERAL

A. Refer to Section 04 20 00 for general installation requirements of unit masonry.

3.3 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. General

1. Do not wet concrete masonry units (CMU).

2. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8" joints.

B. Walls

1. Pattern Bond: Lay CMU wall units in 1/2 running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.

2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimensions indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells on non-reinforced vertical cells, or provide units with solid bottoms.

C. Grouting

1. Use "Fine Grout" per ASTM C 476 for filling spaces less than 4" in one or both horizontal directions.

2. Use "Course Grout" per ASTM C476 for filling 4" spaces or larger in both horizontal directions.

D. Low-Lift Grouting

1. Provide minimum clear dimension of 2" and clear area of 8 sq. in. in vertical cores to be grouted.
2. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 ft.
3. Lay CMU to maximum pour height. Do not exceed 5' height, or if bond beam occurs below 5' height stop pour at course below bond beam.
4. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1-1/2" below top course of pour.
5. Bond Beams - Stop grout in vertical cells 1-1/2" below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

END OF SECTION

SECTION 042214 - MASONRY PATCHWORK

PART 1 - GENERAL

1.1 REFERENCES

A American Society for Testing and Materials (ASTM):

1. C55 Specification for Concrete Brick.
2. C90 Specification for Loadbearing Concrete Masonry Units.
3. C91 Specification for Masonry Cement.
4. C144 Specification for Aggregate for Masonry Mortar.
5. C150 Specification for Portland Cement.
6. C270 Specification for Mortar for Unit Masonry.

1.3 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

1.2 SUBMITTALS

A. Properly identified manufacturer's literature before starting work.

B. Samples: Properly identified samples of masonry units and each type of metal anchor and accessory.

1.3 QUALITY ASSURANCE

A. Submit unit masonry manufacturer's "CM-2" Certificate of Compliance issued by the Florida Concrete and Products Association for each type of unit masonry specified.

B. U-block is not allowed.

1.4 PROJECT CONDITIONS

A. Environmental Conditions:

1. Temperature: 40 degrees F. minimum and rising.
2. Weather: No application during precipitation.

PART 2 - PRODUCTS

2.1 LOAD BEARING AND NON BEARING CONCRETE UNIT MASONRY

A. Weight: Normal.

B. Size: 8 inches x 16 inches x 8 inches thick or as indicated on drawings, 2 cell stretcher type.

C. Texture: Medium.

D. Grade: ASTM C90; Grade N-1, amended to allow a maximum moisture content of 50 percent total absorption.

2.2 CONCRETE BRICK

A. Grade: ASTM C55, Grade N-1, amended to allow a maximum moisture content of 50 percent total absorption.

B. Size: Appropriate to suit conditions.

2.3 MORTAR

A. Portland Cement: ASTM C150, Type I, domestic.

B. Masonry Cement: ASTM C91, domestic.

C. Sand: ASTM C144.

D. Water: Potable.

E. Mortar Mix: ASTM C270, Type S, 1800 psi. Mix accurately in following proportions by volume:

1. Type S:
   a. 1 part masonry cement.
   b. 1/2 part Portland cement.
   c. 4 parts sand.

PART 3 - INSTALLATION

3.1 PATCHING

A. Remove existing mortar from new opening.

1. Fill in as required with new concrete masonry units and fresh mortar.

B. Laying Units:

1. Lay masonry plumb, true to line, with level and accurately spaced courses.

2. Keep bond plumb throughout.

3. Where adjustment must be made after mortar has started to harden, remove mortar and replace with fresh mortar.

4. Cut masonry units dry.

5. Joints: 3/8" thick thickness, strike flush.

C. Jointing Methods:

1. Lay concrete block with full beds of mortar on vertical and horizontal face shells.
   a. Furrowing of mortar is not allowed.

D. Pointing: Point holes in masonry. Cut out and point up defective joints.

3.2 MORTAR FILLED ITEMS

A. Where necessary and where indicated on drawings.

B. Voids around penetrations through block work.

END OF SECTION

SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections apply to work on this Section.

1.02 DESCRIPTION OF WORK

A. Provide structural steel work as shown on drawings and specified herein. Hoisting of the metal deck shall be the responsibility of Contractor. Structural steel is that work defined in AISC "Code of Standard Practice" and as otherwise shown on drawings.

1.03 QUALITY ASSURANCE

A. Codes and Standards

1. Comply with provisions of following, except where more stringent requirements are shown or specified
2. AISC "Code of Standard Practice for Steel Buildings and Bridges."
3. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," including the "Commentary" and Supplements thereto as issued.
4. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
5. AWS D1.1 "Structural Welding Code," latest editions.
6. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use.

B. Qualifications for Welding Work

1. Qualify welding processes and welding operators in accordance with the WS "Standard Qualification Procedure."
2. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months.
3. If recertification of welders is required, retesting will be the Contractor's responsibility and at his expense.

1.04 COORDINATION

A. Contractor shall fully coordinate the structural steel work. Coordinate with Metal Deck Installer for hoisting of the metal deck.

B. Contractor shall fully verify all dimensions and details. Any discrepancies shall be immediately reported to the Architect.

C. Contractor shall locate dimensionally on setting plans all anchor bolts, inserts, base plates, etc. and shall prepare and deliver all required templates and fully dimensioned setting plans, all in time for the proper execution of the work.

D. Contractor shall set the anchor bolts and inserts. Contractor shall field survey all such settings for correctness after they have been cast in place, and before proceeding with steel erection. Checking shall be performed within ten days of notification by concrete installer that his work is complete.

E. Contractor shall within 10 days report to the Architect and certify that he has complied with the above checking requirements and shall indicate any inaccuracies found and corrections which must be made. Any inaccuracies not included in this report and found during or after steel erection shall be the responsibility of the Contractor, and the cost of corrective measures shall be borne by him.

F. Use base lines, bench marks, or other standards for survey work. If permanent building bench marks have been established, they will be used for the aforementioned field checking.

G. Contractor shall coordinate erection areas and sequence and temporary bracing locations.

1.05 SUBMITTALS

A. Product Data

1. Submit 4 copies of producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

a. Structural Steel (each type), including certified copies of mill reports covering the chemical and physical properties.
b. High strength bolts.
c. Structural steel primer paint.

B. Shop Drawings

1. Shop drawings shall give all necessary information for the fabrication and erection of the structure and shall be based on AISC Specifications. Minimum connections used shall be as indicated on the drawings and shall support the total uniform load capacity of members. Provisions for the connection of other work required shall be indicated and provided by Steel Installer. Index sheets shall be furnished with all beam and column details at the same time the details are submitted for the review of the Architect. Standard connection details conforming to those shown on the drawings shall be submitted with first erection plan. All details shown are typical; similar details apply to similar conditions, unless otherwise indicated.
2. The review of shop drawings shall be for size and arrangement of principal members and strength of connections only.
3. Provide anchor bolt and setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

4. Promptly notify the Engineer whenever design of members and connections for any portion of the structure are not clearly indicated.
5. Shop drawings shall bear the initials of the detailer's checker prior to submission.
6. Shop drawings shall indicate the sequence and extent of areas to be erected by using division or derrick numbers.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay that work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. The Contractor shall be responsible for any demurrage charges due to failure to unload or store materials properly. Structural steel shall be kept properly drained. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures.

D. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.

E. Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the City.

F. Shop Fabrication and Assembly

1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on approved shop drawings. Provide camber in structural members where indicated.
2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

G. Connections

1. Shop connections shall be welded or high strength bolted. Field Connections shall be bolted with high strength bolts in friction-type connections conforming to ASTM Designation A325, except where welded connections or other connections are indicated.
2. Combinations of bolts and welds in the same connections are not permitted, unless otherwise shown on the drawings.
3. Where structural joints are made using high strength bolts, hardened washers and nuts tightened to a high tension; the materials, methods of installation and tension control, type of wrenches to be used, and inspection methods shall conform to ASTM Designation A325 as approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation. Each bolt shall have a hardened washer under the nut.
4. The high strength bolts used shall have a suitable identifying mark placed on top of the head before leaving the factory.

5. Tightening of nuts shall be done with properly calibrated pneumatic wrenches. The minimum bolt tension for the size of the bolt used shall be in accordance with tables listed in the above referenced Standards. Each wrench shall be checked for accuracy at least once daily for actual conditions of application.
6. Bolts that have been completely tightened shall be marked with identifying symbols.
7. The Contractor shall have a properly calibrated torque gauge on hand, and when requested by the Architect, shall provide a check on any bolt at any time until final acceptance of the work by the City.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes, including pitting, seam markers, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding or by welding and grinding prior to cleaning, treating, and application of surface finishes.

B. Structural Steel Shapes, Plates, and Bars: ASTM A36

C. Steel Pipe: ASTM A53, Types E or S, Grade B.

D. Anchor bolts shall conform to ASTM A307 with size and shape as indicated on the drawings.

E. Column Base Plates: ASTM A36

F. Arc Welding Electrodes shall conform to the AWS Code as Revised. All electric current require shall be furnished by Contractor.

G. Paint for Shop Painting Structural Steel and Field Touch-up shall be manufacturer's standard primer.

H. All items exposed to weather, such as shelf angles and items as noted on the drawings, shall be zinc coated in accordance with the provisions of ASTM Designation A123 as revised to date.

2.02 FABRICATION

A. General: Fabricate items of structural steel in accordance with AISC Specifications and as indicated on the approved shop drawings.

B. Bearing surfaces shall be planed to true beds, and abutting surfaces shall be closely fitted. All columns and bearing stiffeners shall be milled to give full bearings.

C. Bolt holes shall be drilled or punched in accordance with AISC Specifications, subject to the provisions specified herein. Holes shall be accurately centered and shall register true upon

erection. Poor matching of holes shall be cause for a rejection. Small errors may be repaired by drilling or reaming.

D. Contact surfaces shall be thoroughly cleaned before assembly. Assembled parts shall be brought into close contact. Drift pins shall be used only for aligning members and shall not be used in a manner which will damage metal or enlarge or distort holes. Members requiring accurate alignment shall be provided with slotted holes and/or washers for truing up the steel as required. All finished members shall be true to line and free from twists, bends, and open joints.

E. Welding shall be performed by operators qualified in accordance with the American Welding Society "Standard Qualification Procedure" to perform the type of work required. Such qualification test shall have been passed within the preceding 12-month period. Shop drawings shall indicate the size, length, spacing, and type of all welds. Comply with AWS Code for procedures, appearance and quality of welds, and for methods used in correcting welding work.

F. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on approved shop drawings.

G. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.

H. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.03 SHOP PAINTING

A. Provide one shop coat of paint as specified under Article "Materials" to all steel except for members receiving galvanizing or as specified hereafter.

B. Paint shall be delivered to the shop in original sealed containers which shall be clearly marked with the manufacturer's name and the identifying brand number or name. The paint shall be used as prepared by the manufacturer without thinning or other admixtures.

C. Surface Preparation: After inspection and before shipping, clean steelwork to be painted complying with Steel Structures Painting Council (SSPC) SP-2 "Hand Tool Cleaning," or SSPC SP-3 "Power Tool Cleaning."

D. Do not paint contact surfaces which are to be welded or high-strength bolted. No paint shall be applied within 3" of any high strength bolt holes.

E. Do not paint any zinc-coated items.

F. Paint shall be applied under dry and dust-free conditions and unless otherwise allowed by the Architect, shall not be applied when the temperature is below 45 deg. F. Painting shall be done in workmanlike manner so as to produce an even dry film of uniform thickness of 2 mil. Edges, corners, crevices, and joints shall receive special attention so that they are thoroughly cleaned and they receive an adequate thickness of paint.

PART 3 - EXECUTION

3.01 ERECTION

A. General: Installer must examine the areas and conditions under which structural steel work is to be installed, and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Codes: Comply with the AISC Specifications and Code of Standard Practice, and as herein specified. Maintain work in a safe and stable condition during erection.

C. Anchor Bolts: Steel installer shall furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Steel installer shall furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Contractor shall set anchor bolts and other insert anchors required.

D. Field Assembly: Set structural members to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

E. Temporary Shoring and Bracing: Provide as required, with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy line to achieve proper alignment of the structures as erection proceeds. Coordinate locations of temporary bracing with the Contractor.

F. Splice members only where indicated.

G. Do not enlarge unfair holes in members by burning or by the use of drift pins. Ream or drill holes that must be enlarged to admit bolts.

H. Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing.

I. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraided areas of the shop paint, and paint all exposed areas with the same materials as used for shop painting. Apply by brush or spray to provide a minimum dry file thickness of 2.0 mils.

3.02 QUALITY CONTROL

A. The Contractor shall notify the Architect in writing five days in advance of the starting of fabrication and of erection of the structural steel.

B. The City and his agents shall have free access and the Contractor shall provide same, to all points where materials for this project are being fabricated and/or erected, and all materials,

equipment and workmanship shall be subject to inspection, tests and approval by the City's agents or laboratories. They shall have full authority to reject all material and work that fails to conform in every respect to these specifications.

C. City will engage in independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.

D. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements and specifically state any deviations therefrom.

E. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specific requirement.

F. Shop inspection will include periodic inspection at the place of fabrication and identification of tested material, checking of fabrication for compliance with approved shop drawing and these Specifications, and inspection of shop painting, as well as the following:

1. Examination of all steel for straightness and alignment.
2. Examination of all fabricated pieces and checking of same with erection plans and detail drawings.
3. Shop-Bolted Connections: Inspect in accordance with AISC Specifications. See paragraph entitled "High Strength Bolt Inspection" below.
4. Shop Welding: Inspect and test during fabrication of structural steel assemblies as follows:

a. Check that welders are certified. Record type and locations of defects found in work. Record work required and performed to correct deficiencies or defects found.
b. Perform periodic visual inspections of random welds.
c. Perform the following:

1. Ultrasonic Inspections: ASTM E164. 100% of first 400 butt welds or more until rejection rate is less than 5% and then 25% as long as rejection rate remains below 5%.
2. Magnetic Particle Testing: ASTM E109. 25% of fillet welds with size larger than 3/8".

5. Examination of surface preparation, painting/priming and galvanizing.

G. Field inspection will include periodic inspection after delivery at site of material, fabrication, and shop painting, and work connected with erection and field painting of steel structure, as well as the following:

1. Proper erection of all pieces.
2. Proper installation of bolts.
3. Plumbness of structure.
4. Condition of shop painting after erection and field touch-up painting.
5. Field-Bolted Connections: Inspect in accordance with AISC specifications. See paragraph below titled "High-Strength Bolt Inspection."
6. Field Welding: Inspect and test during erection of structural steel as follows:

a. Check that welders are certified. Record types and locations of defects found in work. Record work required and performed to correct deficiencies or defects found.
b. Perform periodic visual inspections of random welds.
c. Perform the following:

1. Ultrasonic Inspection: All penetrating welds performed in the field shall be tested by ultrasonic testing.
2. Magnetic Particle Testing: Perform as described above.
3. High Strength Bolt Inspection: Perform inspection of installation of high-strength bolts to determine that selected installation procedures as prescribed in the Specification for structural joints using ASTM A325 or A490 bolts are properly used and that bolts are properly tightened and as follows:

a. All bolted connections shall be visually inspected.
b. At least two bolts of every connection between girders and columns and trusses and columns shall be checked.
c. All bolted connections that fail shall be corrected and all bolts in that connection shall be retested.

H. Contractor shall correct deficiencies in structural steel work, which inspections and laboratory test reports have indicated to be not in compliance with requirements, perform additional tests, at Contractor's expense, as may be necessary to re-confirm any non-compliance of the original work, and as may be necessary to show compliance of corrected work.

I. When required by Architect or Contractor's engaged Inspection Organization, Contractor shall make available to Inspector a calibrated torque wrench and calibrating device, as well as the manpower required to operate same, for the purpose of checking high-strength bolts. Adequate platforms and scaffolding shall be provided to ensure safe performance of this operation.

J. Report Copies and Timing: Immediately after tests or inspection have been made, and in no case later than seven (7) days after tests of inspection have been made, the

END OF SECTION

SECTION 05 21 00 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Provide steel joists work as shown on the drawings and specified herein.

B. Related Work Specified Elsewhere

1. Structural Steel Framing: Section 05 12 00.

2. Metal Decking: Section 05 30 00.

C. REFERENCES (All latest editions)

1. ASTM A 307: Carbon Steel Threaded Standard Fasteners.

2. ASTM A 325: High Strength Bolts for Structural Steel Joints.

3. AWD D1.1: Structural Welding Code.

4. SSPC: Steel Structures Painting Council.

5. Steel Joist Institute (SJI): Standard Specification for Open Web Steel Joists, K-Series, Standard Specifications for Long Span Steel Joists, LH Series and Deep Long Span Steel Joists, DLH Series, and Standard Specification for Joist Girders.

1.03 QUALITY ASSURANCE

A. Conform to SJI Standard Specifications, Load Tables, and Weight Tables.

1.04 SHOP DRAWINGS

A. Indicate profiles, sizes, spacing, and locations of structural members, connections, attachments, fasteners, cambers, and loads.

B. Indicate specified procedures concerning erection and fastening of steel joists.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Open Web Steel Joist Members: SJI Type K Open Web and Type LH longspan.

B. Primer Manufacturer's standard primer.

2.02 FABRICATION

A. Fabricate steel joists in accordance with SJI Standard Specifications, including headers, supplementary framing, and cambers.

B. Provide bottom and top joist chord extensions when indicated.

C. Clean steel work to be painted complying with Steel Structures Painting Council, SSPC SP-3, "Power Tool Cleaning".

D. Shop prime structural steel members. Do not prime surfaces to be field welded or high strength bolted.

PART 3 - EXECUTION

3.01 ERECTION

A. Erect steel joists in accordance with SJI Standard Specifications.

B. Bear joists on supports in accordance with SJI Standard Specifications and the drawings.

C. During erection, provide temporary bracing for induced loads and stresses.

D. Field weld joist seat to bearing surface after aligning and positioning joists and after installation of bridging. Deep longspan joists and joist girders shall be high strength bolted.

E. Do not field cut or alter joists without approval of the Architect.

F. After erection, prime welds, abrasions, and surfaces not primed. Use the same primer as the specified shop coat.

END OF SECTION

SECTION 052123 – STEEL JOIST GIRDER FRAMING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Design and manufacture of joist girders.

B. Delivery, storage and erection of joist girders.

1.02 Related Work Specified Elsewhere

A. Columns, beams, and girders - Structural Steel Framing – 05 12 00

B. Steel Joists Framing – 05 21 00

C. Metal Decking – 05 30 00

1.03 QUALITY

A. General - The design, fabrication and installation of joist girders shall be in accordance with requirements of the SJI and the AISC.

B. Design - Joist girders shall be designed for loading conditions indicated including consideration for wind uplift and concentrated loads where required. Bottom chord extensions shall be furnished and installed as shown on the drawings. Extra bracing required to accommodate wind uplift shall be furnished by the manufacturer.

C. Inspection - The fabricator shall inspect all joist girders at time of manufacture and shall be responsible for the accuracy of size, type, span and method of assembly. The fabricator shall accommodate and make access to his manufacturing facilities for inspection when requested.

PART 2 - PRODUCTS

2.01 STEEL

A. The steel used in fabrication of joist girders shall conform to the requirements indicated in the Standard Specifications of the SJI. Certified test reports of materials shall be made available upon request.

2.02 PAINT

A. All joist girders and accessories shall receive on shop coat of rust inhibitive paint. Paint shall be of gray color unless otherwise indicated.

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. Fabrication – Joist girders shall be fabricated to correct dimensions and shall be cambered for zero deflection under full dead load. All welding, whether manual or automatic, shall be carefully inspected by the manufacturer for adequacy. Slots for bolted connections shall be 1/2 inch long with width sufficient for 3/4 inch diameter bolts.

B. Handling, Delivery and Storage - Joist girders shall be loaded, shipped and unloaded in a manner that will avoid bending and twisting. Special care shall be exercised to insure that welds are not damaged. Under no condition shall joist girders be dropped. After unloading, all joist girders shall be stored vertically on supports that will prevent contact with the ground but which shall be slightly sloped to facilitate drainage. Joist girders delivered with bends, twists or kinks shall be removed and replaced by the manufacturer at no additional cost.

C. Erection - Joist girder shall be installed as indicated on the plans and fastened to the supports by means of welding or bolting. Minimum welding on steel supports, i.e. beam or embedded plate, shall consist of 2 welds 3 inches long. Welding electrodes shall be E70 series and all welding shall be performed by certified welders in accordance with the requirements of the AWS.

3.02 QUALITY CONTROL

A. Inspection and testing shall be in accordance with Section 05 10 00.

END OF SECTION

SECTION 053000 - METAL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Provide metal decking as shown on the drawings, including basic layout and type of deck units required, and specified herein.

B. Related Work Described Elsewhere

1. Structural Steel Framing - Section 05 12 00.

1.3 QUALITY ASSURANCE

A. Codes and Standards

1. Comply with provisions of the following codes and standards, except as otherwise shown or specified.
2. AISI "Specifications for the Design of Cold-Formed Steel Structural Members."
3. AWS "Structural Welding Code."
4. SDI "Design Manual for Floor Decks and Roof Decks."
5. MRDTI "Specifications for Steel Roof Deck Construction" as adopted by the Metal Roof Deck Technical Institute.

B. Qualifications of Field Welding

1. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure." Welding decking in place is subject to inspection and testing by a Testing Laboratory engaged by the City.

Remove and replace work found to be defective and not complying with requirements.

1.04 PERFORMANCE REQUIREMENTS

A. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 91.5 psf at high roof overhang, 76.5 psf at low roof overhang, 52.0 psf at Zone 1 roof area and 62.8 psf at Zones 2 and 3 roof areas.

B. Underwriter's Label: Provide metal deck units manufactured by a firm listed in the Underwriter's laboratories "Fire Resistance Director - Index of Manufacturers." Each required type deck unit shall bear the UL label and marking.

1.5 SUBMITTALS

A. Product Data: Submit four copies of manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.

B. Shop Drawings: Submit detailed drawings showing size and location of floor and roof framing supports, layout and types of deck panels, deck finish and method, lengths and piece marks of deck units, fastening and anchorage details, and any openings to be cut in field. Deck units shall be marked to show sequence or erection. Detailed drawings shall also indicate closure pieces, fittings, sump pans, any special jointing, and other accessories necessary to provide a complete decking installation. Indicate welds by standard welding symbols adopted by The American Welding Society. Weld washers shall be used for all roof deck.

1.6 COORDINATION

A. Contractor shall coordinate loading of deck units on the steel frame and erection sequence with Structural Steel Installer. Contractor shall coordinate the actual size and depth of sump pans.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metal Deck

B. Roof Deck Units: Roof deck shall be galvanized (G90) metal deck. See “Roof Framing Notes” in the roof plan for size and locations. Areas where insulating systems are used, galvanized (G90) metal deck, size and location per “Roof Framing Notes”.

C. Floor Deck Units: Floor deck shall be galvanized (G90) metal deck. See “Floor framing Notes” in the floor plans for size and locations.

D. Metal Cover Plates: Fabricate metal cover plates for end-abutting deck units of not less than 18 gage sheet steel. Form to match contour of deck units and approximately 6 inches wide.

E. Metal Closure Strips: Fabricate metal closure strips, for openings between decking and other construction, of not less than 18-gage sheet steel. Form to provide tight-fitting closure at open ends of cells or flutes and sides of decking.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer must examine areas and conditions under which metal decking is to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until satisfactory conditions have been corrected in a manner acceptable to installer.

3.2 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturer's recommendations and approved shop drawings, and as specified herein.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

C. Place deck units in straight alignment for entire length of run.

D. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

E. Coordinate and cooperate with structural steel installer in loading decking bundles to prevent overloading of structural members.

F. Do not use floor deck units for storage or working platforms until permanently secured.

G. End Closures: Tack weld or use machine screws at 3'-0" o.c. for fastening end closures.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, the appearance and quality of welds, and the methods used in correcting welding work.

I. Side Laps: Steel roof deck and floor deck shall have nesting side laps of adjacent units attached by 3/4-inch diameter #12 screws or button punching at the center of each span or 30 inches o.c., whichever is a least dimension, unless noted otherwise on plans.

J. Cutting and Fitting: Saw cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking as shown on the drawings.

K. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units.

L. Closure Strips: Provide metal closure strips at all open perimeter ends, interior openings, uncovered ends and edges of roof and floor decking, and in the voids between decking and other construction. Weld into position to provide a complete decking installation.

M. Touch-Up Painting: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on the top surface of roof deck units.

N. Touch-up painted surfaces with the above specified paint applied in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 055213 – ALUMINUM PIPE AND TUBE RAILING

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 work of this section.

1.2 DESCRIPTION OF WORK:

A. Definition: Metal fabrications include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.

B. Extent of metal fabrications is indicated on drawings and schedules.

C. Types of work in this section include metal fabrications for:

1. Aluminum Pipe Railings and Handrails

2. Access Ladders

D. Structural steel is specified in another section within Division 5.

Paint application for structural steel frames is specified in Division 9.

1.3 SYSTEM PERFORMANCES:

A. Structural Performances: Provide assemblies which, when installed, comply with the following minimum requirements for structural performance, unless otherwise indicated.

B. All Assemblies shall comply the Florida Building Code 2020 and ASCE 7-10.

1. Handrails and Toprails: Capable of withstanding the following loads applied as indicated when tested per ASTM E 935.

a. Concentrated loads of 200 lbs. applied at any point in any direction.

b. Uniform load of 50 lbs per linear ft. applied simultaneously in both vertical and horizontal directions.

2. Guards: Intermediate rails, balusters and panel fillers capable of withstanding a uniform load of 25 lb. per sq. ft. of gross area of guard, including any open areas, of which they are a part.

1.4 QUALITY ASSURANCE:

A. Shop Assembly: Pre-assemble items in 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.

1.5 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

B. Sustainability Submittals: Florida Green Building Coalition (FGBC) min. Silver rating

C. Shop Drawings: Submit Engineered shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections, and structural calculations. Show anchorage and accessory items. Provide templates for anchor and bolt installation by Contractor. Shop drawings must be signed and sealed by a State of Florida registered engineer. Engineering shall comply with the latest Florida Building Code and ASCE 7-10.

D. Samples: Submit 2 sets of representative samples of materials and finished products as may be requested by Design Team.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Aluminum Metals:

1. Aluminum Railings: ASTM B 221, 6063-T6

a. Aluminum Rivets: ASTM B 316, alloy 6053-T4 or 6061-T6

2. Fasteners for Aluminum Railings: Use fasteners made of same basic metal as fastened metal except use stainless steel fasteners for exterior aluminum units, unless otherwise indicated. Do not use metals which are corrosive or incompatible with metals joined.

B. Grout:

1. Metallic Non-Shrink Grout: Pre-mixed, factory-packaged, ferrous aggregate grout complying with CE CRD-C588, Type M.

2. Non-Shrink Non-Metallic Grout: Pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with CE CRD-C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

C. Fasteners for steel assemblies:

1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

2. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A

3. Lag Bolts: Square head type, FS FF-B-561

4. Machine Screws: Cadmium plated steel, FS FF-S-92

5. Wood Screws: Flat head carbon steel, FS FF-S-111

6. Plain Washers: Round, carbon steel, FS FF-W-92

7. Masonry Anchorage Devices: Expansion shields, FS FF-S-325

8. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.

9. Lock Washers: Helical spring type carbon steel, FS FF-W-84

D. Paint:

1. Shop Primer for Ferrous Metal: Manufacturer's or Fabricator's standard, fast-curing, lead-free, "universal" primer; selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated and

for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure; complying with performance requirements of FS TT-P-645.

2. Manufacturer: Carboline Carbo Zinc 11 HS Inorganic Zinc Primer

2.2 FABRICATION, GENERAL:

A. Workmanship: Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise indicated. Form bent- metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts.

E. Provide for anchorage of type indicated, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

F. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

G. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes here water may accumulate.

2.3 ALUMINUM PIPE RAILINGS AND HANDRAILS:

A. Fabricate aluminum pipe railings and handrails to design, dimensions, and details indicated. Provide railings and handrails members formed of pipe of sizes and wall thickness indicated, but not less than that required to support design loading.

B. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

1. At tee and cross intersections provide coped joints.

2. At bends interconnect pipe by means of prefabricated elbow fittings or flush radius bends, as applicable, of radii indicated.

3. At elbow bends provide mitered joints.

4. Form bends by use of prefabricated elbow fittings and radius bends or by bending pipe, at fabricator's option.

C. Form simple and compound curves by bending pipe to jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of pipe.

D. Provide wall returns at ends of wall-mounted handrails, except where otherwise indicated.

E. Close exposed ends of pipe by welding 3/16" thick steel plat in place or by use of prefabricated fittings.

F. Toe Boards: Where indicated, provide toe boards at railings around openings and at the edge of open-sided floors and platforms. Fabricate to dimensions and details indicated, or if not indicated, use a 4: high x 1/8" plate welded to, and centered between, each railing post.

G. Brackets, Flanges, Fittings and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railing and handrails to concrete or masonry work.

1. For railing posts set in concrete provide sleeves of galvanized steel pipe not less than 6" long and with an inside diameter not less then 1/2" greater than the outside diameter of pipe. Provide steel plate closure welded to bottom of sleeve and of width and length not less than 1" greater than outside diameter of sleeve.

2. Provide friction fit, removable covers designed to keep sleeves clean and hold top edge of sleeve 1/2" below finished-surface of concrete.

2.4 ACCESS LADDERS:

A. Fixed Ladder Bottom Bracket:

1. Bottom wall supported bracket.

B. Materials

1. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

2. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

C. Fabrication

1. Rungs: Not less than 1-1/4 inches in section and 18–3/8 inches long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.

2. Rungs shall withstand a 1,500-pound load without deformation or failure.

3. Channel Side Rails: Not less than 1/8-inch wall thickness by 3 inches wide.

4. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8-inch wall thickness by 3 inches wide. Construction shall be self-locking stainless-steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.

D. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.

E. Landing Platform: 1-1/2 inches (38 mm) or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.

F. Ladder Safety Post: Retractable hand hold and tie off.

G. Access Control:

1. Fabricate ladder with 8-foot high hinged lockable panel to prevent unauthorized access to the roof.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION:

A. Aluminum Pipe Railings and Handrails:

1. Adjust railing prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loading. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:

   a. Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with non-shrink, non-metallic grout, mixed and placed to comply with grout manufacturer's directions.

   b. Anchor posts to steel with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.

   c. Anchor rail ends into concrete and masonry with steel round flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.

   d. Anchor rail ends to steel with steel oval or round flanges welded to rail ends and bolted to structural steel members, unless otherwise indicated.

2. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2" clearance from inside face of handrail and finished wall surface. Locate brackets as indicated, or if not indicated, at spacing required for design loading. Secure wall brackets and wall return fittings to building construction as follows:

   a. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

   b. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.

   c. For hollow masonry anchorage, use toggle bolts having square heads.

d. For stud partitions use lag bolts set into wood backing between studs. Coordinate with stud installations for accurate location of backing members.

3. Expansion Joints: Provide expansion joints at locations indicated, or if not indicated, at intervals not to exceed 40 feet. Provide slip joint with internal sleeve extending 2" beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6" of posts.

B. Access Ladders

1. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction and as per details provided on the construction documents.

3.3 ADJUST AND CLEAN:

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting.

B. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

C. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 of these specifications.

D. For Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

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.

B. Florida Building Code, Latest Edition, "Wood" Chapter 2314 to 2330 – High Velocity Hurricane Zone requirements apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. FSC Certified Wood
2. Wood blocking, cants, and nailers.

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NLGA: National Lumber Grades Authority.
2. SPIB: The Southern Pine Inspection Bureau.
3. WCLIB: West Coast Lumber Inspection Bureau.
4. WWPA: Western Wood Products Association.

1.4 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 specified to be High-Temperature (HT) type, 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.

5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

6. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

C. SUSTAINTABILITY SUBMITTALS: Florida Green Building Coalition (FGBC) min. Silver rating

1.5 QUALITY ASSURANCE

A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

B. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

1. Al l dimension lumber and specialty lumber products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 FOREST STEWARDSHIP COUNCIL (FSC) CERTIFIED LUMBER:

A. Manufacturer:

1. Collins Lumber (800.329.1219)

2. Or Approved Equal

3. Al l dimension lumber and specialty lumber products:

a. Thickness/Width: up to 3" x 12" S4S

b. Lengths: 6' through 20'

c. Percent FSC Certified Required: 100%

2.2 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 and provide certificates of grade compliance issued by grading agency.

3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

4. Provide dressed lumber, S4S, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do 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 and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat all rough carpentry, unless otherwise indicated.

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. Fire blocking

4. Rooftop equipment bases and support curbs.

5. Cants.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

C. 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.

D. 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.

E. All concealed wood element must be fire treated with a minimum 1-hour rating.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough 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 Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.6 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4-inch-thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. 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.

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

D. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

D. Do not splice structural members between supports, unless otherwise indicated.

E. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.

2. Use copper naphthenate for items not continuously protected from liquid water.

G. Securely attach rough carpentry work and sheathing to substrate by anchoring and fastening as indicated on drawings and complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2324.1, "Fastening Schedule," in FBC's Florida Building Code, Latest Edition, High Velocity Hurricane Zone.

H. Use common wire 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; do not countersink nail heads, unless otherwise indicated.

I. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with indicated fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.

2. Use finishing nails, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

J. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 PROTECTION

A. Protect rough carpentry from weather.

END OF SECTION

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following:
   1. Exterior wall sheathing.
   2. Sheathing joint-and-penetration treatment.
   3. Flexible flashing at openings in sheathing.

1.2 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

B. Section 07 13 00 – Sheet Waterproofing.

1.3 REFERENCE STANDARDS

A. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2006.

B. ASTM C 1178/C 1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2006.

C. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2008a.

D. Florida Building Code: Building; Latest Edition (2020).

1.4 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 specified to be High-Temperature (HT) type, 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 a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
   1. Preservative-treated plywood.
   2. Fire-retardant-treated plywood.

C. Sustainability Submittals: Florida Green Building Coalition (FGBC) min. Silver rating

D. Comply with the current Florida Building Code (2020), High Velocity Hurricane Zone.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance 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."

B. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
   1. Plywood.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 GLASS-MAT GYPSUM WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
   1. Manufacturers: Subject to compliance with requirements, provide one of the following products:
      a. G-P Gypsum Corporation; Product Dens-Glass Exterior Sheathing: www.gp.com.
      b. National Gypsum Company; Product Gold Bond e2xp Extended Exposure Sheathing: www.nationalgypsum.com.
      c. Temple-Inland Inc; Product GreenGlass: www.templeinland.com.
      d. U.S. Gypsum, Inc.; Product Securock: www.usg.com.
      e. Substitutions: See Section 01 61 00 – Basic Product Requirements
   2. Type and Thickness: Regular, 1/2 inch or Type X, 5/8-inch-thick where indicated on the drawings.
   3. Type and Thickness: Regular, 1/4 inch where indicated on the drawings.
   4. Size: 48 by 96 inches.

2.2 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA C9.

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 flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Comply with performance requirements in AWPA C27.
1. Use treatment that does not promote corrosion of metal fasteners.
2. Use Exterior type for exterior locations and where indicated.
3. Use Interior Type A, unless otherwise indicated.

B. 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.

C. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Application: Treat plywood indicated on Drawings:

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. For wall sheathing, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
1. For wall sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

F. 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.

2.6 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants."

B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: 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 board and with a history of successful in-service use.

2.7 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.025 inch.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
      b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Plus Self-Adhered Flashing.
      c. MFM Building Products Corp.; Window Wrap.
      d. Polyguard Products, Inc.; Polyguard 300.

B. Flexible Flashing: Self-adhered flashing is composed of durable, cross-laminated, high density polyethylene aluminum surfaced sheet, backed by an aggressive, pressure sensitive rubberized asphalt adhesive. Provide flashing at locations where exterior sealant is applied for optimum sealant adhesion.
   1. Basis of Design Manufacturer and Product: Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Perm-A-Barrier Aluminum Flashing.

C. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

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. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
   3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's "Uniform Building Code."
   4. Table 2305.2, "Fastening Schedule," in BOCA's "BOCA National Building Code."
   5. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."
   6. 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."
   7. Florida Building Code (FBC) High Velocity Hurricane Zone requirements.
   8. Factory Mutual (FM)

D. Use common wire 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. Install fasteners without splitting wood.

E. 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.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. 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 applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
   1. Wall Sheathing:
      a. Screw to cold-formed metal framing.
      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. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
   3. 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 boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.
   1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity 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 board joints and apply and 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.

3. Apply flexible aluminum flashing at openings where exterior sealant contacts flexible flashing for optimum sealant adhesion.

3.5 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.
   1. Prime substrates as recommended by flashing manufacturer.
   2. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
   3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
   4. Lap weather-resistant building paper over flashing at heads of openings.
   5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION

SECTION 064116 – PLASTIC LAMINATE – CLAD ARCHITECTURAL CABINETS

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 work of this section.

1.2 SUMMARY

A. This Section includes the following:

1. Plastic-laminate cabinets.

2. Solid-surfacing-material countertops.

1.3 Related Sections include the following:

A. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

1.4 REFERENCES:

A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

B. American Wood Council (AWC):

1. AWC DCA, "Design for Code Acceptance."

C. Architectural Woodwork Institute (AWI):

1. AWI AWS, "Architectural Woodwork Standards."

D. ASTM (ASTM):

1. ASTM D 523, "Standard Test Method for Specular Gloss."

2. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."

E. Forest Stewardship Council (FSC):

1. FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

F. Hardwood Plywood and Veneer Association (HPVA):

1. ANSI/HPVA HP-1, "American National Standard for Hardwood and Decorative Plywood" (copyrighted by HPVA, ANSI approved).

2. HPVA HPH, "Hardwood Plywood Handbook."

3. HPVA VSG, "Veneer Species Guide."

1.5 QUALITY ASSURANCE:

A. AWI Quality Standard: Quality Standard: Comply with AWI AWS for grades of architectural woodwork, construction, finishes, and other requirements. Provide AWI certification labels or AWI certificates of compliance indicating that woodwork meets requirements of grades specified.

B. Coordination: Distribute copies of approved schedule for cabinet hardware specified in Division-8 section “Finish Hardware” to manufacturer of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

C. Installer Qualifications: Arrange for installation of architectural woodwork items by same firm which fabricated them.

D. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

E. Mock-Ups: Prior to installation of the work, fabricate and erect mock-ups for each type of finish and application required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups using materials indicated for final unit of work.

F. Pre-Installation Conference: Conduct pre-installation conference in accordance with Section 013100 - Project Management and Coordination. Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Mock-ups shall be reviewed during the pre-installation conference. Pre-installation conference shall include, but shall not be limited to, the General Contractor, the Installer, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the City and the Design Team.

1.6 SUBMITTALS:

A. General: See Section 013300 - Submittal Procedures.

B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Submit product data for each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

C. Shop Drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer’s standard product data, including, but not limited to, location of each item, in dimensioned plans and elevations, large scale details, attachment devices, and other components.

D. Samples:

1. Submit samples for verification purposes. Additional samples may be required to show fabrication techniques and workmanship.

a. Lumber with or for transparent finish; 12” X 3/4” X 18”, for each species and cut, finished on one side and one edge.

b. Plastic laminate, 8” X 10” for each type, color, pattern and surface finish.

c. Exposed cabinet hardware, one unit of each type and finish.

d. Solid-surfacing materials, 8” X 10” for each type, color, pattern and surface finish.

e. Plywood, 12” x 12” x 3/4"

E. Quality Certification: Submit woodwork Manufacturer’s certification, stating that fabricated woodwork complies with quality grades and other requirements indicated.

F. SUSTAINABILITY SUBMITTALS: Florida Green Building Coalition (FGBC) min. Silver rating

1.7 DELIVERY, STORAGE AND HANDLING:

A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver woodwork, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

C. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers (or suitable equivalent protection), labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.

D. Store decorative hardwood plywood and fabricated products in dry interior locations where temperature is maintained between 60°F (16°C) and 90°F (32°C) and relative humidity is maintained between 30 percent and 55 percent.

E. Remove or loosen plastic wrappings. Sticker individual panels to hasten acclimatization.

F. Cover decorative hardwood plywood panels and fabricated products to protect from exposure to light until installed.

G. Protect decorative hardwood plywood from edge and surface damage.

1.8 PROJECT CONDITIONS:

A. Environmental Limitations: Woodwork Manufacturer and Installer shall advise General Contractor of temperature and humidity requirements for woodwork installation and storage areas. Do not deliver or install work until building is enclosed, wet-work is completed and nominally dry, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. Require Woodwork Manufacturer to establish optimum moisture content and required temperature and humidity conditions.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Wood Moisture Content: Comply with requirement of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas. Fabricate woodwork to dimensions, profiles, and details indicated with openings and mortises precut, where possible, to receive hardware and other items and work.

1. Ease edges to a 1/16" radius, for corners of cabinets and edges of solid wood (lumber) members less than 1" in nominal thickness, 1/8" radius for edges of rails and similar members over 1" in nominal thickness.

B. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming and fitting.

C. Pre-Cut Openings: Fabricate architectural woodwork with pre-cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutoffs and, where located in countertops and similar exposure seal edges of cutouts with a water-resistant coating.

D. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit.

E. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork for accurate fit.

F. Assemble casing in plant except limitations of access to place of installation require field assembly.

2.2 ARCHITECTURAL CABINETS, LAMINATE CLAD:

A. Quality Standard: Comply with AWI Section 400 and its Division 400B.

B. Laminate Clad Cabinets: Comply with the following requirements:

1. Grade: Custom.

2. Type of Cabinet Construction: Flush overlay

3. Laminate Cladding: High pressure decorative laminate complying with NEMA LD 3 and as follows:

a. Colors, Patterns and Finishes: As indicated in Finish Legend or, if not otherwise indicated, as selected by Design Team from laminate manufacturers' standard products in the following categories:

1) As indicated on drawings.

b. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.

1) Horizontal Surfaces Other Than Tops: GP-50 (0.050" nominal thickness).

2) Post-formed Surfaces: PF-42 (.042" nominal thickness).

3) Vertical Surfaces: GP-28 (0.028" nominal thickness).

4) Plastic Laminate cladding

c. Core Material: 3/4" Exterior-grade plywood.

2.3 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Premium.

B. High-Pressure Decorative Laminate Grade: HGS.

1. Colors, Patterns and Finishes: As selected during Construction Document phase by General Contractor's consultant and approved by the City.

C. Fabricate tops in one piece, unless otherwise indicated.

D. Fabricate tops with loose full height backsplashes for field application.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: 3/4" Exterior-grade plywood.

G. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

H. Install integral sink bowls in countertops in shop. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.4 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Premium.

B. Solid-Surfacing-Material Thickness: 3/4 inch (19 mm).

1. Colors, Patterns and Finishes: As selected during Construction Document phase by General Contractor's consultant and approved by the City.

C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.

2. Fabricate tops with loose full height backsplashes for field application.

D. Install integral sink bowls in countertops in shop. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.5 CABINET HARDWARE AND ACCESSORY MATERIALS:

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items which are specified in Division-8 section "Finish Hardware".

B. Cabinet Hardware Schedule: Refer to schedule at the end of this section for cabinet hardware required for architectural cabinets.

C. Hardware Schedule: Comply with ASNI/BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BHMA numbers or referenced to this standard.

D. Hardware Finishes: Comply with BHMS 1301 for finishes indicated by BHMA code Numbers or if not otherwise indicated, provide finishes complying with requirements indicated below:

1. For exposed hardware comply with requirements indicated for finish and base indicated by BHMA Code Number below:

a. 630 (Satin Stainless Steel).

E. For concealed hardware provide manufacturer's standard finish which complies with product class requirements of ASNI/BHMA A156.9.

F. Clear Tempered Float Glass for Doors: FS DD-G-1403, grade B, style I type I, quality 3, class 1 seamed at edges prior to tempering; 1/4 inch thick, unless otherwise indicated.

2.6 FASTENERS AND ANCHORS:

A. Screws: Select material, type, size and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

B. For metal framing supports, provide screws as recommended by metal framing manufacturer.

C. Nails: Select material, type, size and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

D. Anchors: Select material, type, size and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion-resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.7 FACTORY FINISHING OF INTERIOR ARCHITECTURAL WOODWORK:

A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.

B. General: The entire finish of interior architectural woodwork is work of this section, regardless of whether factory-applied or applied after installation.

C. Factory Finishing: To the greatest extent possible, finish architectural woodwork at factory. Defer only final touch-up, cleaning and polishing for time after delivery and installation.

D. General: The primary and pre-finishing of interior architectural woodwork required to be performed at factory is work of this section. Refer to Division-9 sections for final finishing of installed architectural woodwork, and for material and application requirements of prime coats for woodwork not specified to receive final finish as work of this section.

E. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing of concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

B. Pre-Installation Meeting: Meet at project site prior to delivery of architectural woodwork and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work.

C. Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of time substrates are to be built.

D. Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION:

A. Install woodwork plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including tops); and with no variations in flushness of adjoining surfaces

B. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

C. Anchor woodwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where pre-finished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.

D. Cabinets: Install without distortion so that 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 the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish.

E. Tops: Anchor securely to base units and other support systems as indicated.

3.3 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION:

A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.

D. Complete the finishing work specified as work of this section, to whatever extent not completed at shop or prior to installation of woodwork.

E. Provide final protection and maintain conditions, in a manner acceptable to Fabricator and Installer, which ensures architectural woodwork being without damage or deterioration at time of substantial completion.

3.4 CABINET HARDWARE SCHEDULE: (as specified or Approved Equal)

A.

ITEM	DESCRIPTION	IDENT. NO.	LOCATION
Butt Hinges	Wrought Tempered Steel		1 Pr. Per

	Hospital Tip, 5-Knuckle 2-3/4" Instit. Tight Pin		Door to 48"H - 1.5 Pr. Per Door over 48"
Continuous Hinges	Wrought Steel	BHMA B81491	Where Indicated
Casework Pulls	ABS Plastic, Semi-Recess		1 ea. Drawer/ Door to 24" Wide. 2 ea. Drawer over 24" Wide
Cabinet Catches	H.D., Magnetic	BHMA B43172 Hafele 246.50	1 ea. Casework Door
Adjustable Shelf Standards & Shelf Rests	Wrought Steel	K & V 255/256	Where Indicated 4 Rests per Shelf
Standards & Brackets	Wrought Steel	K & V 871186	Where Indicated, 2 Brackets at 30" c.c.
Drawer Slides	Side Mount Ball Bearing	Hafele 421.74 Min. 100 Lb. Load	2 each Drawer
Casework Locks	Disc Tumbler	National 68-504 Corbin 0696	Where Indicated
Grommets	Rectangular	Mockett	Workstation

Satin Aluminum 9” x 3” x 9/16” deep With hinge lid and brush panel	MAX2/B-94 or Approved equal	Countertops every 6’-0”

END OF SECTION

SECTION 067300 – COMPOSITE DECKING

PART 1 GENERAL

Location: Main stairs at entrance floor finish.

1.01 SECTION INCLUDES

A. Composite Decking (LambooFusion™ Decking)

B. Composite Decking (Rim Board)

1.02 RELATED SECTIONS

A. Section 05 12 00 - Structural Steel Framing.

B. Section 05 21 00 - Steel Joist Framing.

1.03 REFERENCES

A. ASTM International (ASTM):
1. ASTM D1037: Water Absorption of Plastics.
2. ASTM D1761: Mechanical Fasteners in Wood.
3. ASTM D1413: Test method for Wood Preservatives by Laboratory Soil-block Cultures.
4. ASTM D7031: Standard Guide for Evaluating Mechanical and Physical Properties of Wood-Plastic Composite Products, ASTM International.
5. ASTM D7032: Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails).
6. ASTM E84: Test Method for Surface Burning Characteristics of Building Materials, ASTM International.

B. Code Reports:
1. Nationally Recognized Testing Facilities:
   a. Uniform Building Code (UBC)
   b. International Building Code (IBC)

1.04 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations
2. Storage and handling requirements and recommendations
3. Installation methods

B. Shop Drawings:
1. Provide plans and details which include layout, spacing, and sizes of decking and railings.

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, representing actual product color, size, and finish.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5-year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2-year experience installing similar products.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Store products on a flat and level surface. Adjust support blocks accordingly.

C. Support bundles on supplied dunnage.

D. When stacking bundles, supports should start approximately 8 inches from each end and be spaced approximately 2 feet on center. Supports shall line up vertically/perpendicular to the decking product.

E. Do not stack LambooFusion™ decking more than 10 bundles high.

F. Keep material covered using the provided bundle cover until time of installation.

G. Minimize Handling materials to avoid damage.

1.07 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 recommended limits.

1.08 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.09 WARRANTY

A. Provide manufactures warranty against rot, decay, splitting, checking, splintering, fungal damage, and termite damage for a period of 15 years for a residential

installation and 10 years for a commercial installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Lamboo Technologies, LLC; 301 West Edwards Street, Litchfield, IL 62056. Tel: (866) 966-2999. Fax: (217) 250-2198. Email: sales@lamboo.us Web: http://www.lamboo.us Contact: Jeran Hammann

B. Substitutions: allowed approved equal.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.02 Design/Performance Requirements:

A. Structural Performance:
   1. Deck: Uniform Load - 100lbf/sq.ft.
   2. Tread of Stairs: Concentrated Load: 750 lbf on area of 4 sq. in., and 1/8 inch maximum deflection at a concentrated load of 300 lbf.

B. Fire-Surface Burning Characteristics per ASTM E-84.

2.03 COMPOSITE DECKING

A. Bamboo-Plastic Composite Decking:
   1. Product: Lamboo® LambooFusion™ Decking Boards as manufactured by Lamboo Technologies, LLC.
   2. Material Description: Composite Decking consisting of recycled High Density Polyethylene (HDPE) and recycled bamboo fiber. The product is extruded into shapes and sizes as follows:
      a. Thickness: 7/8 inch (22mm)
      b. Width: 5.5 inches (140 mm)
      c. Lengths - 12 feet (3658 mm) and 16 feet (4877 mm)
      d. Color - To be specified by customer

   3. Physical and Mechanical Properties as follows:
      a. Flame Spread, ASTM E 84: 70
      b. Thermal Expansion, ASTM D 1037: 0.000030 inch/inch/degree F
      c. Moisture Absorption, ASTM D 1037: Less than 1 percent
      d. Screw Withdrawal, ASTM D1761: 602 lbs/in.
      e. Fungus Resistance, ASTM D1413: Rating - no decay
      f. Termite Resistance, AWPAE1-72: Rating: 9.8
      g. Compression Parallel, ASTM D198: 1698 psi ultimate, 570 psi design.
      h. Compression Perpendicular, ASTM D143: 1430 psi ultimate, 520 psi design.
      i. Bending Strength, ASTM D198: 3280 psi ultimate, 500 psi design.
      j. Shear Strength, ASTM D143: 1751 psi ultimate, 330 psi design.
      k. Modulus of Elasticity, ASTM D4761: 504,000 psi ultimate, 220,000 psi design.

l. Modulus of Rupture, ASTM D4761: 4,134 psi ultimate, 700 psi design.
m. Ultimate strength values are not meant for design analysis. Design values are for temperatures up to 125 degree F (52 degree C)

B. Bamboo-Plastic Composite Lumbers:
1. Product: Lamboo® LambooFusion™ Composite Lumber as manufactured by Lamboo Technologies, LLC.
2. Pattern: 3D Wood Embossed or Sanded Texture
3. Material Description: Composite Decking consisting of recycled High Density Polyethylene (HDPE) and recycled bamboo fiber. The product is extruded into shapes and sizes as follows:
a. Lumber Sizes: ¾" thick up to 1-1/2" / Width: 3-1/2" up to 12-1/4"
b. Lengths - 12 feet (3658 mm) and 16 feet (4877 mm)
c. Color - To be specified by customer

4. Physical and Mechanical Properties as follows:
a. Flame Spread, ASTM E 84: 70
b. Thermal Expansion, ASTM D 1037: 0.000019 inch/inch/degree F
c. Moisture Absorption, ASTM D 1037: Less than 1 percent
d. Screw Withdrawal, ASTM D1761: 602 lbs/in.
e. Fungus Resistance, ASTM D1413: Rating - no decay
f. Termite Resistance, AWPAE1-72: Rating: 9.8
g. Compression Parallel, ASTM D198: 1698 psi ultimate, 570 psi design.
h. Compression Perpendicular, ASTM D143: 1430 psi ultimate, 520 psi design.
i. Bending Strength, ASTM D198: 3280 psi ultimate, 500 psi design.
j. Shear Strength, ASTM D143: 1751 psi ultimate, 330 psi design.
k. Modulus of Elasticity, ASTM D4761: 504,000 psi ultimate, 220,000 psi design.
l. Modulus of Rupture, ASTM D4761: 4,134 psi ultimate, 700 psi design.
m. Ultimate strength values are not meant for design analysis. Design values are for temperatures up to 125 degree F (52 degree C)

C. Composite Decking and Lumber Colors:
1. Color: Driftwood Gray
2. Color: Sandstone Hickory
3. Color: Desert Sand
4. Color: Coffee
5. Color: Cinnamon

D. Surface Options:
1. 3D Wood Embossed
2. Sanded Texture

E. Accessory Hardware:
1. Fasteners:
a. Lamboo Hidden Fasteners
b. Composite Decking Screws: (provided by Installers)

PART 3 EXECUTION

3.01 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.

3.02 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.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.

B. Cut, drill, and rout using carbide tipped blades.

C. Do not use composite wood material for structural applications.

3.04 Cleaning

A. Cleaning as required by manufacturer for warranty compliance.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.06 Contractor to coordinate recess of new slab, or construction to provide recessed installation for flush transitions at finish floors. Typical at all conditions.

END OF SECTION

SECTION 067413 – GRATINGS - REINFORCED PLASTIC GLASS FIBER

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. Metal frames and supports for gratings.

B. Related Sections:

1. Division 05 Section "Structural Steel Framing" for structural-steel framing system components.

2. Division 05 Section "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

1.3 PERFORMANCE REQUIREMENTS

A. 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 125 lbf/sq. ft. (6.00 kN/sq. m) or concentrated load of 2000 lbf (8.90 kN), whichever produces the greater stress.

2. Floors: Uniform load of 250 lbf/sq. ft. (11.97 kN/sq. m) or concentrated load of 3000 lbf (13.40 kN), whichever produces the greater stress.

3. Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft. (2.87 kN/sq. m).

4. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft. (4.79 kN/sq. m).

5. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. (11.97 kN/sq. m) or concentrated load of 8000 lbf (35.60 kN), whichever produces the greater stress.

6. Limit deflection to L/240 1/4 inch (6.4 mm), whichever is less.

B. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Glass-fiber-reinforced plastic gratings.

2. Clips and anchorage devices for gratings.

B. Sustainability Submittals: Florida Green Building Coalition (FGBC) min. Silver rating

C. Shop Drawings: Include plans, sections, details, and attachments to other work.

D. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

E. Welding certificates.

F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for 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.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED PLASTIC GRATINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Grating, LLC.
2. Creative Pultrusions, Inc.
3. Enduro Systems Inc.; Composite Products Division.
4. Fibergrate Composite Structures Inc.
5. Fisher & Ludlow; Division of Harris Steel Limited.
6. Grating Pacific, Inc.
7. Seasafe, Inc.; a Gibraltar Industries company.
8. Strongwell Corporation.

B. 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: 1-1/2-inch deep x 1-1/2- inch x 1-1/ 2- inch high capacity.

2. Resin: Vinyl Ester

a. Flame-Spread Index: 25 or less when tested according to ASTM E 84.

3. Color: Manufacturer's standard

4. Traffic Surface: Applied abrasive finish

2.2 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.

E. 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.

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.

3.3 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 same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 071300 - SHEET WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.2 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

C. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

D. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

E. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

F. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

G. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test).

H. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.

J. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

K. ASTM D5602/D5602M - Standard Test Method for Static Puncture Resistance of Roofing Membrane Specimens.

L. ASTM D6134 - Standard Specification for Vulcanized Rubber Sheets Used in Waterproofing Systems.

M. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

N. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

O. ASTM F2130 - Standard Test Method for Measuring Repellency, Retention, and Penetration of Liquid Pesticide Formulation Through Protective Clothing Materials.

P. NRCA (WM) - The NRCA Waterproofing Manual.

1.3 SUBMITTALS

A. See Section 01 33 00 for submittal procedures.

B. Product Data: Provide data for membrane.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in City of Delray Beach's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years' experience.

1.5 MOCK-UP

A. Construct mock-up consisting of 100 sq ft of horizontal waterproofed panel; to represent finished work including internal and external corners.

B. Locate where directed.

C. Mock-up may remain as part of this Work.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. CONTRACTOR shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to the City of Delray Beach.

C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.1 WATERPROOFING APPLICATIONS

A. Composite HDPE/Bentonite Sheet Membrane:

1. Location: Below grade vertical surfaces.

2. Vertical Surfaces: Adhesive bonded to substrate.

3. Cover with drainage panel.

2.2 MEMBRANE MATERIALS

A. Composite HDPE/Bentonite Sheet Membrane: Comprised of black/gray HDPE and granular bentonite with spun polypropylene fabric facing.

1. Thickness: 0.150 inch (150 mil), minimum.

2. Sheet Width: 4 feet, minimum.

3. Water Absorption: >0.2 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.

4. Manufacturers:

a. CETCO: www.cetco.com/#sle.

2.3 ACCESSORIES

A. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.

1. Composition: Dimpled polystyrene core; polypropylene filter fabric.

a. Products:

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.2 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

3.3 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.

D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

H. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches above horizontal surface for first ply and 18 inches at subsequent plies laid in shingle fashion.

I. Seal membrane and flashings to adjoining surfaces.

3.4 INSTALLATION - DRAINAGE PANEL

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.

3.5 FIELD QUALITY CONTROL

A. CONTRACTOR will provide testing services in accordance with Section 01 40 00 - Quality Requirements. CONTRACTOR shall provide temporary construction and materials for testing.

B. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.

C. Flood to minimum depth of 1 inch with clean water, and after 48 hours inspect for leaks.

D. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by DESIGN TEAM; repeat flood test, and repair damage to building.

E. When area is proven watertight, drain water and remove dam.

3.6 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 071800 TRAFFIC COATINGS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes traffic coatings for pedestrian and vehicular traffic locations indicated on Drawings.

B. Sustainability Requirements:

1. Solar reflectance index.

2. Low-emitting paints and coatings.

1.2 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

PART 2 – MATERIALS

2.1 MANUFACTURERS

A. Source Limitations:

1. Obtain traffic coatings from single source from single manufacturer.

2. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.

3. Obtain pavement-marking paint from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A, Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.3 TRAFFIC COATING

A. Traffic Coating: Manufacturer's standard, traffic-bearing, seamless, high-solids-content, cold liquid-applied, elastomeric, water-resistant membrane system with integral wearing surface for pedestrian and vehicular traffic according to ASTM C 957.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, surface smoothness, and other conditions affecting performance of traffic-coating work.

B. Verify that substrates are visibly dry and free of moisture.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after substrate construction and penetrating work have been completed.

2. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.

3. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Clean and prepare substrates in accordance MUTCO 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. Priming: Unless manufacturer recommends in writing against priming, prime substrates in accordance with manufacturer's written instructions.

1. Limit priming to areas that will be covered by traffic-coating material on same day. Reprime areas exposed for more time than recommended by manufacturer.

C. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

D. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.

3.3 PROTECTING AND CLEANING

A. Protect traffic coatings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 071923 - WATER REPELLENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Applications of Water Repellents on concrete masonry walls.

1.2 RELATED SECTIONS:

A. Section 04 20 00 – Unit Masonry

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E-514 Water Penetration Through Masonry – Average reduction in Leakage Rate - 83% B.

B. National cooperative Highway Research Program:

2. N.C.H.R.P. Report 244 Series 2 – 77% Reduction in Chloride Ion Content

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.

B. Quality Assurance/Control Submittals: Submit the following:

1. Certificates: Submit certificate that applicator complies with requirements of this section.

1.5 QUALITY ASSURANCE

A. Applicator should follow manufacturer's installation instructions.

B. Test Area: Test a minimum 4 ft. by 4 ft. area on each type of masonry. Use the manufacturer's application instructions. Let test area protective treatment cure before inspection. Keep test panels available for comparison throughout the protective treatment project.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before applying water repellant, review procedure, substrate, mortar and method to ensure quality of work. Require representatives of each entity directly concerned to attend, including the following:

a. Contractor's superintendent.

b. Independent testing agency responsible for Masonry testing.

c. Masonry subcontractor.

1.6 DELIVERY, STORAGE & HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B Storage and Protection: Shelf life for an unopened container is one year. Keep containers tightly sealed when not in use. Store in a dry location with a temperature range between 40 - 100°F (4 - 38ºC).

1.7 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Comply with application temperature range of 40 - 100°F (4 - 38ºC).

B. Surface should be completely dry. Allow at least 24 hours with sunshine for drying if the surface was wet.

C. Do not apply if rain is expected within 3 hours.

D. Do not apply during very windy conditions. High winds can cause excessive application rate.

1.8 WARRANTY

A. Provide one-year material warranty from manufacturer.

PART 2 PRODUCTS

2.1 Water Repellent

A. Manufacturer: PROSOCO, Inc. Waterproofing & Building Products

1. Contact: 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255; Fax: (785) 830-9797 E-mail: CostomerCare@Prosoco.com

B. Water Repellents and related products, including the following:

1. Sure Klean Weather Seal Siloxane WB Concentrate:

a. Material: Water-based emulsion siloxane water repellent

b. Color: Clear amber liquid

c. Total Solids: 48% ASTM D5095

d. Application Method: Spray

e. Freeze Point: 22ºF

2.2 PRODUCT SUBSTITUTIONS

A. Substitutions: No substitutions permitted.

2.3 LIMITATIONS

A. New concrete must be cured a minimum of 28 days before application.

B. Tuck-pointing must be cured a minimum of 3 days and caulking(s) should be fully cured before application.

C. Surface pores must be opened up sufficiently to allow immediate penetration of sealer.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with the most current written installation instructions and recommendations of the waterproofing manufacturer. Dilute with clean, potable water only. Mixing vessels must be clean, dry and free of contaminants. When added to water, Siloxane WB turns milky white. Mix lightly to produce a uniform consistency. One gallon of Siloxane WB concentrate produces up to 20 gallons of water repellent (on dense vertical surfaces).

3.2 EXAMINATION

A. Site Verification of Condition:

1. Verify that site conditions are acceptable for application of the waterproofing system.

2. Do not proceed with application until unacceptable conditions are corrected.

3.3 PREPARATION

A. Surface Preparation:

1. If absorption test failed, cleaning of the substrate may be necessary. See manufacturer for detailed cleaning procedures.

2. Remove all traces of curing compounds.

3. Concrete surfaces should be cleaned and free of dirt, oil, grease and other contaminants.

4. Cover and protect all glass, aluminum, metal, grass, shrubs, plants and vegetation from overspray.

5. Agitate sealer before application.

3.4 APPLICATION

A. For vertical application Spray

1. Apply a single application of the sealer with low pressure spray equipment (15 psi or .1 MPa) roller or broom.

2. Use a fan spray nozzle for greatest efficiency, mist spraying will only waste material.

3. Apply material from the bottom of the wall upwards so that it will run down the surface at least 6 inches below the spray pattern.

3.5 CLEANING

A. Equipment – Clean with soap and water.

B. Adjacent construction – Clean using soap and water before dry.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

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 work of this section.

1.2 DESCRIPTION OF WORK**:**

A. Extent of insulation work is shown on drawings and indicated by provisions of this section.

B. Applications of insulation specified in this section include the following:

1. Board-type roof insulation.

1.3 QUALITY ASSURANCE:

A. Thermal Resistivity: Where thermal resistivity properties of insulation materials are designated by r-values they represent the rate of heat flow through a homogenous material exactly 1" thick, measured by test method included in referenced material standard or otherwise indicated. They are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

B. Fire Performance Characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

1. Surface Burning Characteristics: ASTM E 84.

2. Fire Resistance Ratings: ASTM E 119.

3. Combustion Characteristics: ASTM E 136.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's product literature and installation instructions for each type of insulation and vapor retarder material required.

B. Sustainability Submittals: Florida Green Building Coalition (FGBC) min. Silver rating

1.5 DELIVERY, STORAGE, AND HANDLING:

A. General Protection: Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following: (or Approved Equal)

1. Manufacturers of Polyisocyanurate Board Roof Insulation:

a. RMAX Operating LLC

b. The Dow Chemical Company

c. Polyglass USA Inc.

2.2 INSULATING MATERIALS:

A. General: Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics. No asbestos containing materials are to be provided.

B. Polyisocyanurate Board Insulation (For exterior and roof insulation applications only): Rigid, cellular thermal insulation with glass-fiber-reinforced polyisocyanurate closed-cell foam core and inorganic facing laminated to both sides; Minimum R-value of 6 at 40° and 75° F (4.4° and 23.9° C) per 1" of thickness, respectively; and as follows:

Density: 2.0 pounds per cubic foot minimum.

1. Surface Burning Characteristics: Maximum values for flame spread and smoke developed of 60 and 160, respectively.
2. Compressive strength: 20 pounds per square inch minimum.
3. Water Vapor Transmission: 1.5 perm maximum
4. Water Absorption: 1% volume maximum
5. Dimensional stability: 2 percent maximum linear change when conditioned at 158 F (70 C) and 98 percent relative humidity for seven days.
6. Curing time: 24 hours minimum, plus an additional 24 hours minimum per inch (25 mm) of thickness, at a minimum of 60 F (16 C) before shipment from the manufacturer.
7. Maximum Board size: 4-foot by 8-foot (1.2-m by 2.4-m) maximum board size for loose-laid and mechanically attached insulation boards, 4-foot by 4-foot (1.2-m by 1.2-m) maximum board size for insulation boards adhered to a substrate.
8. Board thickness: 2 inches (51 mm) maximum; when thicker total thicknesses are necessary, provide insulation boards in multiple layers to achieve the desired total thickness. When multiple insulation layers are used, the insulation board's joints in the top layer should be staggered vertically and offset from the joints in the underlaying layer(s).
9. Tapered insulation shall be used on top of the concrete roof slab. Slope top of the tapered insulation 1/4" per 1’-0” to roof drain.

2.3 AUXILIARY INSULATING MATERIALS:

A. Adhesive for Bonding Insulation: Type recommended by insulation manufacturer and complying with requirements for fire performance characteristics.

B. Roof Insulation Mechanical Anchors:

1. Minimum 6 fasteners per 4’ x 8’ board secured to structural deck.
2. Type and size as recommended by roofing membrane manufacturer for type of application and condition of substrate.

C. Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints between units and filling voids in work.

D. Protection Board: Pre-molded, semi-rigid asphalt/fiber composition board, 1/4" thick, formed under heat and pressure, standard sizes. Georgia Pacific Dens Deck (or equal).

E. Crack Sealer for Board Insulation: Provide polymeric insulating foam in aerosol dispenser designed for filling voids in board insulation.

1. Product: Subject to compliance with requirements, provide "Polycel 100" by Construction Products Div., W.R. Grace & Co.

2. Or Approved Equal

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION:

A. Require Installer to examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified. Obtain Installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL:

A. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

B. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections, which interfere with placement.

C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

D. Slope insulation around roof drains.

3.3 INSTALLATION OF GENERAL BUILDING INSULATION:

A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. 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. Seal joints between closed-cell (non-breathing) insulation units by applying 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 mastic or sealant.

3.4 PROTECTION:

A. General: Protect installed insulation and vapor retarders from harmful weather exposures and from possible physical abuses, where possible by non-delayed installation of concealing work or, where that is not possible, by temporary covering or enclosure.

B. All insulation products should not be exposed to weather during shipping, storage or installation.

END OF SECTION

SECTION 072600 - VAPOR RETARDERS

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. Polyethylene vapor retarders.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor retarders.

2. Section 072100 "Thermal Insulation" for vapor retarders integral with insulation products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 15-mil- (0.25-mm-) thick sheet, with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).

2.2 ACCESSORIES

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 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.

3.3 PROTECTION

A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION

SECTION 072700 – CLOSED-CELL POLYURETHANE FOAM INSULATION

PART 1 -

PART 2 - GENERAL

2.1 SECTION INCLUDES

A. This section includes the following:

1. Closed-cell, medium-density spray polyurethane foam insulation located above and below conditioned spaces adjacent to non-conditioned roof / floor.

B. Related Work in other Sections includes the following:

1. Section 014000 - Quality Requirements; coordination with City's independent testing and inspection agency.
2. Section 015000 - Temporary Facilities and Controls; requirement to schedule work to prevent sunlight and weather exposure of materials beyond limits established by manufacturer; requirement to protect materials from damage after installation and prior to installation of enclosing work.
3. Section 033000 – Cast-In-Place Concrete; requirement that backup concrete be smooth without protrusions.

2.2 PERFORMANCE REQUIREMENTS

A. Material Performance:

1. Density (ASTM D 1622): 2.1 lb/ft3 (34 Kg/m3).
2. Thermal Resistance (ÅSTM C 518):
   a. R-7.4 (sf.h degree F/BTU) Aged R value at 1 inch 180 days at 76 degrees F (23 degrees C)
3. Water Vapor Permeance at 1.5 inches (ÅSTM E 96-05): 0.79 perms (is a vapor barrier per IBC Section 202 definitions at 1.2 inches)
4. Air Permeance at 75 Pa at 1 inch (ÅSTM E 2178-03): 0.001 L/sm2
5. Compressive Strength (ÅSTM D 1621): 20.6 psi (142 kPa).
6. Tensile Strength (ASTM D 1623): 45.4 psi (313 kPa)
7. Off Gassing Test (VOC Emissions) (CGSB 51.23-92): Pass (no toxic vapor).
8. Surface Burning Characteristics (ÅSTM E 84) 4 inches: Class I. Flame Spread Index 20, Smoke Developed Index 400.
9. Closed Cell Content (ASTM D 2856) : >92 percent.
10. Water Absorption Percent by Volume (ÅSTM D 2842): 0.3 percent.
11. Recycled Content: 14.6 percent (pre- and post-consumer).

B. Assembly Performance:

1. Air Leakage of Air Barrier Assembly (static loading to 600 Pa and gust loading to 1,200 PA) Complies with ABAA requirements (ASTM E 2357-05): <0.0022L/sm2

2. Assembly shall be capable of withstanding combined design wind, fan and stack pressures, both positive and negative on the envelope without damage or displacement and shall transfer the load to the structure.

3. Assembly insulation material shall not displace adjacent materials in the assembly under full load.

4. Assembly shall be joined in an airtight and flexible manner to the insulation material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep.

C. Locations: Install closed-cell spray polyurethane foam insulation where indicated at drawings:

2.3 SUBMITTALS

A. Submittals: Submit in accordance with Division 01 requirements.

B. Quality Assurance Program: Submit evidence of current contractor accreditation and installer certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of the contractor and certification numbers of the installers.

C. Product Data: Submit manufacturer's product data, manufacturer's instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.

1. Include VOC content of each material.

2. Include statement that materials are compatible with adjacent materials proposed for use.

3. Include recommended values for field adhesion test on each substrate.

4. Include recycled content.

D. Sustainability Submittals: Florida Green Building Coalition (FGBC) min. Silver rating

E. Samples: Submit clearly labeled samples, three inch by 4-inch minimum size of each material specified.

F. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.

G. Insulation Subcontractor Qualifications: Subcontractor shall be accredited at time of bidding and during the complete installation period by the Air Barrier Association of America (ABAA) whose installers are certified in accordance with the site Quality Assurance Program used by ABAA.

1. Closed-cell, medium density sprayed polyurethane foam insulation installers shall be certified by BPQI (Building Performance Quality Institute) for the ABAA Quality Assurance Program in accordance with the requirements outlined in the QAP program used by ABAA. Installers shall have their photo-identification air barrier certification cards in their possession and available on the project site, for inspection upon request.

H. Manufacturer: Obtain primary ABAA listed materials from a single ABAA Licensed manufacturer regularly engaged in manufacturing specified closed-cell, medium density sprayed polyurethane foam. Obtain secondary materials from a source acceptable to the primary materials manufacturer.

I. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds.

J. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, sequence of construction, coordination with substrate preparation, insulation materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction and chemical/fire safety plans. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

K. Field Quality Assurance: Implement the site Quality Assurance Program requirements used by ABAA. Cooperate with ABAA inspectors and any independent testing and inspection agencies engaged by the Contractor. Do not cover the insulation assembly until it has been inspected, tested and accepted.

2.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by insulation spray foam manufacturer. Protect stored materials from direct sunlight.

C. Handle materials in accordance with manufacturer’s recommendations.

2.5 PROJECT CONDITIONS

A. Temperature: Install closed-cell, medium density spray polyurethane foam insulation within range of ambient and substrate temperatures recommended by insulation manufacturer. Do not apply insulation to a damp or wet substrate.

B. Field Conditions: Do not install insulation in snow, rain, fog, or mist. Do not install insulation when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer.

C. Sequencing. Do not install insulation material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

D. Compatibility. Do not allow closed-cell, medium density spray polyurethane foam to come in contact with chemically incompatible materials.

E. Ultra-violet exposure. Do not expose the insulation material to sunlight longer than as recommended by the manufacturer (if applicable).

2.6 WARRANTY

A. Manufacturer's Material Warranty: Provide manufacturer's standard product warranty, for a minimum 3 years from date of Substantial Completion.

B. Subcontractor (approved by ABAA and manufacturer) Installation Warranty: Provide a 2 year installation warranty from date of Substantial Completion, including all components of the insulation assembly, against failures including loss of air tight seal, loss of watertight seal, loss of attachment, loss of cohesion and failure to cure properly.

PART 3 - PRODUCTS

3.1 SPRAY FOAM INSULATION MANUFACTURERS

1. Demilec (USA) LLC – Heat Loc Soy 200 (basis of design)
2. Or approved equal.

3.2 SPRAY FOAM INSULATION MATERIALS

A. Medium Density Closed Cell Spray Polyurethane Foam Insulation:

1. Insulation system shall not require the priming of substrates nor the application of sealing tape at wallboard seams and other wall penetrations.
2. Spray Applied Rigid Polyurethane Closed Cell Foam Insulation System:
   a. Product: HEATLOK SOY 200 Manufactured by DEMILEC (USA) LLC, Arlington, TX, or approved equal.
   b. Product Approval:
      1) International Code Council Evaluation Services Report #3210
      2) Approved for non-structural walls in building types I, II, III, IV, and V construction under IBC and dwellings for IRC.
      3) Approved for exterior walls in building types I, II, III, and IV construction.
      4) Passed AC 377 Appendix X compliant NFPA 286.
3. Application Rate: Up to 2 inches in a single pass, to the total thickness required for the project.
4. Physical Properties:
   a. Nominal Density (ASTM D1622): 2.1 lb/cu.ft.
   b. Compressive Strength, 3-inch thickness (ASTM D1621): 20 psi.
   c. Closed-Cell Content (ASTM D1940): Greater than 90 percent.
   d. R-Value (ASTM C1029 180-day aged): 7.4 per inch.
   e. Water Absorption (ASTM D2842): 0.3 (gm/cc).
   f. Water Vapor Transmission (ASTM E96): 0.79 perms at 1.5 inches.

g. Air Infiltration (ASTM E283): 75 Pa 0.001 L/S/m^2 (1.57 psf) (less than 0.001 cfm/ft^2); 300 Pa 0.001 L/S/m^2 (6.24 psf) (less than 0.001 cfm/ft^2).

h. Air Permeance (ASTM E2178): 75 Pa 0.000055 L/S.m^2.Pa 0.000117 ft^3/min.mw.Pa; 300 Pa 0.000024 L/./m^2.Pa 0.000051 ft^3/min.mw.Pa.

i. Recycled Content: 14.6 percent (pre- and post-consumer).

5. AABA Performance Values:

a. Dimensional Stability (ASTM D2126): Maximum -4% at -4°F, 8% at 176°F and 15% at 158°F.

b. Water Absorption (ASTM D2842): Maximum 4%.

c. Open-cell content (ASTM D6226): Maximum 10%.

d. Pull-adhesion (ASTM D4541): Minimum 16 psi.

e. Crack Bridging (ASTM C1305): Pass at -15°F.

f. Fungi Resistance (ASTM C1338): No growth.

g. Flame Spread Characteristics (ASTM E84): Maximum $\leq$25.

h. Smoke Developed Characteristics (ASTM E84): Maximum $\leq$450.

3.3 ACCESSORY PRODUCTS

A. Water Based Fire Protection:

1. Product: BLAZELOK TB 200 with BLAZELOK TB 200 Primer, Distributed by DEMILEC (USA) LLC, Manufactured by TPR2 or Approved Equal.

2. Application: Install primer first, then intumescent coating. Follow manufacturer's application recommendations.

3. Physical Properties:

a. BLAZELOK TB 200 Primer:

1) Approval: Comply with the 2009 IBC 2603.9 and 803.2; and the NFPA 101 paragraph 10.2.3.7.2 for use without a prescriptive thermal barrier.

2) Surface Burning Characteristics (ÅSTM E 84): Class I. Flame Spread Index 0, Smoke Developed Index 20.

3) Expands up to 2000 percent.

4) Flash Point: None

5) Volatility/VOC: 0

6) Non-toxic, drain safe, water based, non-fuming.

7) Color: Gray

b. BLAZELOK TB 200:

1) Approval: Complies with the 2009 IBC 2603.9 and 803.2; 2009 IRC 302.9.4 and 316.6; 2006 IRC 314.6 and 315.4 and the NFPA 101 paragraph 10.2.3.7.2 for use without a prescriptive thermal barrier.

2) Surface Burning Characteristics (ÅSTM E 84): Class I. Flame Spread Index 5, Smoke Developed Index 20.

3) Expands up to 2000 percent.

4) Flash Point: None

5) Volatility/VOC: < 50 g/L

6) Non-toxic, drain safe, water based, non-fuming.

7) Color: Dull Flat white.

a) Do not add tint.

b) Wait minimum 24 hours prior to top coating with quality latex paint. Verify dryness with moisture meter.

PART 4 - EXECUTION

4.1 EXAMINATION

A. Examine substrates, areas, and conditions under which the insulation assembly will be installed, with Installer present, for compliance with requirements.

1. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

2. Ensure that the following conditions are met:

a. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants.

b. Concrete surfaces are cured and dry, smooth without large voids or sharp protrusions.

3. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 and take suitable measures until substrate passes moisture test.

4. Verify sealants are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.

5. Notify Architect in writing of anticipated problems using closed-cell, medium density spray polyurethane foam over substrate prior to proceeding.

4.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for insulation application.

1. Ensure that penetrating work by other trades is in place and complete.

2. Prepare surfaces by brushing, scrubbing, scraping, grinding or compressed air to remove loose mortar, dust, oil, grease, oxidation, mill scale and other

contaminants which will affect adhesion of the closed-cell, medium density spray polyurethane foam.

3. Where there are release agents or other non-compatible coatings, wipe down metal surfaces to remove these release agents or other non-compatible coatings, using clean sponges or rags soaked in a solvent compatible with the spray polyurethane foam.

4. Ensure metal ceiling anchors are in place.

B. Protection from Spray Applied Materials:

1. Mask and cover adjacent areas to protect from overspray.

2. Ensure any required foam stop or back up material are in place to prevent over spray and achieve complete seal.

3. Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes. Provide for make-up air.

4. Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.

4.3 INSTALLATION

A. Spray Polyurethane Foam Installation: Install materials in accordance with manufacturer's recommendations, ULC S 705.2 and the following:

1. Installer shall use proper personal protective equipment (PPE) during the installation of material in accordance with US Government regulation 29 CFR 1910.134.

2. Warning signs shall be displayed, and non-protected personnel shall be kept from the spray area in accordance with ULC S705.2.

3. Equipment used to spray polyurethane foam shall comply with ULC S 705.2 and the manufacturer’s recommendations for the specific type of application. Record equipment settings on the Daily Work Record as required by the ULC S 705.2 installation standard. Each proportioner unit shall supply only one spray gun.

4. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer or the ULC S 705.2 Installation standard.

5. Apply in consecutive passes as recommended by manufacturer to thickness as indicated on drawings. Passes shall be not less than 1/2 inch (12 mm) and not greater than 3 inches (75 mm). An additional pass shall only be done after the first pass has had time to cool down.

6. Install within manufacturer’s tolerances, but not more than minus 1/4 inch (6 mm).

7. Do not install spray polyurethane foam within 3 inches (75 mm) of heat emitting devices such as light fixtures and chimneys.

8. Finished surface of foam insulation to be free of voids and embedded foreign objects.

9. Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.

10. Trim, as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.

11. Clean and restore surfaces soiled or damaged by work of the section. Consult with section of work soiled before cleaning to ensure methods used will not damage the work.

12. Complete connections to other components and repair any gaps, holes or other damage using material, which conforms to ULC S 710.1 (single component) or ULC S 711.1 (two components) and installed in accordance with ULC S 710.2 or ULC S 711.2 as applicable.

B. Application without a Thermal or Ignition Barrier (exposed foam) over occupied spaces (workshops):

1. Minimum 3" thickness in floors and ceilings with all foam surfaces covered with 4 dry mils (0.10 mm) 7 wet mils (0.18 mm) of Blazelok TB 200 primer then covered with 8 dry mils (0.20 mm) 14 wet mils (0.36 mm) of Blazelok TB 200 intumescent coating.

C. Attics and Crawlspaces: Passed AC 377 Appendix X compliant NFPA 286. (below second floor slab over unconditioned first floor spaces):

1. Minimum 3" thickness on the underside of the second-floor slab and over the joists in attic floors within ceiling cavity with no intumescent coating.

2. HEATLOK SOY 200 may be left exposed without an intumescent coating in accordance with ÅSTM E 970.

4.4 FIELD QUALITY CONTROL

A. City's Inspection and Testing: Cooperate with City's testing agency. Allow access to work areas and staging. Notify City's testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Do not cover Work of this Section until testing and inspection is accepted.

4.5 PROTECTING AND CLEANING

A. Protect insulation materials from damage during installation and the remainder of the construction period, according to manufacturer's written instructions.

1. Coordinate with installation of materials which cover the insulation assemblies, to ensure exposure period does not exceed that recommended by the manufacturer.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 074113 - METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Standing seam metal roofing system.

B. Standing seam metal roofing accessories.

C. Metal roofing accessories.

1.2 RELATED SECTIONS

A. Section 05 30 00 6112 - Metal Decking

B. Section 07 62 00 - Flashing and Sheet Metal

C. Section 07 90 00 - Joint Sealers

1.3 REFERENCES

A. ASTM A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

B. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

C. ASTM B 101 - Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction.

D. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

E. ASTM B 370 - Standard Specification for Copper Sheet and Strip for Building Construction.

F. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

G. ASTM D 1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

H. ASTM D 3575 - Standard Test Methods for Flexible Cellular Materials made from Olefin Polymers.

I. ASTM E 84 - Standard Test for Surface Burning Characteristics of Building Materials.

J. ASTM E 283 - Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

K. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

L. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

M. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.

N. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.

O. ASTM E 2140 - Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head.

P. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.

Q. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

R. FM 4470 Approval Standard for Class 1 Panel Roofs.

S. FM 4471 - Class 1 Panel Roof; Factory Mutual Research Corporation.

T. UL 263 - Fire Tests of Building Constructions and Materials.

U. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies.

V. UL 790 - Standard Test Methods for Fire Tests of Roof Coverings.

W. UL 1897 - Uplift Test for Roof Covering Systems.

X. ICC-ES AC166 - Test Procedure for Wind Driven Rain Resistance of Metal Roof Coverings.

Y. SMACNA - Architectural Sheet Metal Manual.

Z. National Coil Coating Association (NCCA)

AA. NRCA - The NRCA Roofing and Waterproofing Manual.

BB. Miami Dade Notice of Acceptance

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Standing Seam Roofing System: R-Mer Span
   1. Thermal Expansion and Contraction:
      a. Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.
      b. Design temperature differential shall be not less then 200 degrees F.
      c. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.

d. Location of metal roofing rigid connector shall be at roof ridge unless otherwise approved by the Project Architect. Metal ridge connector may require design as per job conditions by specified manufacturer.

2. Uniform Wind Load Capacity:
   a. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria.
      1) Design Code: ASCE 7-16, Method 2 for Components and Cladding.
      2) Safety Factor: 1.67 after any load reduction or material stress increase.
      3) Category III Building with an Importance Factor of 1
      4) Wind Speed: 180 mph.
      5) Exposure Category: C.
      6) Design Roof Height: 15 feet.
      7) Minimum Building Width: 12 feet.
      8) Roof Pitch: 4 inches per foot.
      9) Roof Area Design Uplift Pressure:
         a) Zone 1 – 64.6 psf.
         b) Zone 2r – 86.2 psf.
         c) Zone 2e – 93.4 psf.
         d) Zone 3 – 93.4 psf.

   b. ASTM E 1592: Capacity shall be determined using pleated airbag method in accordance with ASTM E 1592, testing of sheet metal roof panels. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above.
   c. Underwriters' Laboratories, Inc., (UL), wind uplift resistance classification: Roof assembly shall be classified as Class 1-90, as defined by UL 580
   d. FM 4471: Submit test report for negative wind uplift pressures no less than that specified. Roof system must have approval over the substrate specified.

3. Uniform Positive Load Capacity.
   a. Installed roof system shall be capable of resisting the following positive uniform roof loads: Roof Live Load of 20 psf; Roof Snow Load of ___ psf.
   b. Dead Load: Loading of the roof structure, due to tear off of existing, and/or installation of new roofing materials shall not exceed the present loading due to weight of the existing roofing system.
   c. Installed roof system shall carry positive uniform design loads with a maximum system deflection of L/180 as measured at the rib (web) of the panel.

4. Underwriters' Laboratories, Inc., (UL):
   a. Underwriters' Laboratories, Inc., (UL) fire resistance P ratings for roof assemblies: If applicable, panel system shall be approved for use in an appropriate Construction Assembly, as defined by UL 263.
   b. Underwriters' Laboratories, Inc., (UL) Class A fire rating per UL 790.

5. ASTM E 283: Static pressure air infiltration (doors, windows, curtain walls):
   a. Pressure Leakage Rate
      1) 1.57 PSF 0.0007 cfm/sq.ft.

2) 6.24 PSF 0.0002 cfm/sq.ft.
3) 20.0 PSF 0.0036 cfm/sq.ft.

6. ASTM E 331: Static pressure water infiltration (doors, windows, curtain walls):
   a. Pressure Result:
      1) 5 Gal. /Hr. per S.F. and Static No Leakage
      2) Pressure of 20.0 Psf. for 15 minutes
7. ASTM E 1680: Static pressure air infiltration (roof panels):
   a. Pressure Leakage Rate:
      1) 1.57 PSF 0.0028 cfm/sq.ft.
      2) 6.24 PSF 0.0041 cfm/sq.ft.
      3) 20.0 PSF 0.0059 cfm/sq.ft.
8. ASTM E 1646: Static pressure water infiltration (roof panels):
   a. Pressure Result:
      1) 5 Gal. /Hr. per S.F. and Static No Leakage
      2) Pressure of 20.0 Psf for 15 minutes
9. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolations for conditions outside test range are not acceptable.
10. Miami Dade Notice of Acceptance.
    a. 17-0725.06
11. Water penetration (dynamic pressure): No water penetration, other than condensation, when exposed to dynamic rain and 70 mph wind velocities for not less than five minutes duration, when tested in accord with principles of AAMA 501.1.
12. Wind and wind driven rain resistance: No water penetration or panel movement when exposed to 110 mph wind velocities when tested in accordance with TAS 100.
13. Installed roof system assembly shall show that it can resist the calculated roof pressure in accordance with the test results of TAS 125.
14. Water penetration in low slope applications: No water penetration or panel movement when subject to 6 inch head of water for 6 hours when tested in accordance with the ASTM E 2140 and when subject to 6 inch head of water for 7 days when tested in accordance with the TAS 114 appendix G.
15. Submit third party validation of environmental claims, prepared UL Environment, for all metal roof panels containing recycled content and/or bio based content.

1.5 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product Data: Submit product data, test reports, and certifications in accordance with quality assurance and performance requirements specified herein.

C. Design Loads: Submit manufacturer's minimum design load calculations according to ASCE 7, Method 2 for Components and Cladding. In no case shall the design loads be taken to be less than those specified herein.

D. Dead Load Evaluation: Provide documentation from a licensed structural engineer of a structural evaluation of the roof structure and it's suitability for the new imposed

roofing loads.

E. Shop Drawings: Prepared specifically for this project; showing dimensions of metal roofing and accessories, fastening details and connections and interface with other products.

F. FGBC Submittals: Provide documentation of how the requirements of Credit will be met:
   1. List of proposed materials with recycled content. Indicate post-consumer recycled content and pre-consumer recycled content for each product having recycled content.
   2. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.

G. Selection Samples: For each finish product specified, two complete sets of samples representing manufacturer's full range of available colors and textures.

H. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and textures.

I. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

J. Closeout Submittals:
   1. Provide manufacturer's maintenance instructions that include recommendations for periodic checking and maintenance of installed roof system.
   2. Provide executed copy of manufacturer's warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001 approval.

B. Installer Qualifications: Certified and approved installer of the sheet metal roofing manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.7 PRE-INSTALLATION CONFERENCE

A. Convene a pre-roofing conference approximately two weeks before scheduled commencement of roofing system installation and associated work.

B. Require attendance of installers of deck or substrate construction to receive roofing, installers of rooftop units and other work in and around roofing which must precede or follow roofing work including mechanical work, Architect, City, roofing system manufacturer's representative.

C. Objectives include:
   1. Review foreseeable methods and procedures related to roofing work, including set up and mobilization areas for stored material and work area.
   2. Tour representative areas of roofing substrates, inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work.
   3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
   4. Review roofing system requirements, Drawings, Specifications and other Contract Documents.
   5. Review and finalize schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
   6. Review required inspection, testing, certifying procedures.
   7. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
   8. Record conference including decisions and agreements reached. Furnish a copy of records to each party attending.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
   1. Store materials above ground, on skids.
   2. Protect material with waterproof covering and allow sufficient ventilation to prevent condensation buildup or moisture entrapment on the materials.

1.9 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.

1.10 WARRANTY

A. Warranty:
   1. 35 year, no dollar limit, warranty.
   2. Provide installers 5 year warranty covering roofing system installation and water-tightness.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Garland Company, Inc. (The), which is located at: 3800 E. 91st St.; Cleveland, OH 44105; Toll Free Tel: 800-321-9336; Tel: 216-641-7500; Fax: 216-641-0633; Email:request info (ebuczek@garlandind.com); Web:http://www.garlandco.com

B. Requests for substitutions will be considered in accordance with provisions of Section 016000.

2.2 STANDING SEAM METAL ROOFING

A. R-Mer Span:
1. Width of Standing T-Seam Panel: 1 inch T-seam.
   a. 16 inches.
2. Standing Seam: 2-3/8 inch tall mechanically seamed with factory installed hot melt sealant in-seam cap. Panel/Cap is configured with a total of 4 layers of metal surrounding anchor clip.
3. Panel Profile: Provided with minimum 1-1/2 inches wide elevated mesa's every 2 inches on center continuous throughout panel.
   a. Slope: Open Purlins or Solid Substrate down to 1/4:12.
4. Panel material:
   a. Aluminum, 3105-H14 alloy, smooth as per ASTM B 209, .032 inch thickness.
5. Flashing and flat stock material: Fabricate in profiles indicated on Drawings of same material, thickness, and finish as roof system, unless indicated otherwise.
6. Coated Finish:
   a. Exposed surfaces for coated panels:
      1) Two coat coil applied, baked-on full-strength (70% resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2), applied by manufacturer's approved applicator.
      2) Coating system shall provide nominal 1.0 mil dry film thickness, consisting of primer and color coat.
   b. Unexposed surfaces for coated panels shall be baked-on polyester coating with .20 to .30 dry film thickness (TDF).
7. Accessory Components:
   a. Anchor Clips:
      1) Concealed Standard Anchor Clips: Clips 16 gauge stainless steel, alloy 316L, 1 piece clip with projecting legs for additional panel alignment and provision for unlimited thermal movement in each direction along the longitudinal dimension.
   b. Fasteners:
      1) Concealed fasteners: Corrosion resistant steel fasteners (zinc plated, stainless steel or equal) designed to meet structural loading requirements.
         a) Three fasteners per clip are required in Zone 1 only.
         b) Two Fasteners per clip required in Zones 2r, 2e and 3.
         c) Clip Spacing:
            1) Zone 1 – 3’-0”
            2) Zone 2r - 1’-0”
            3) Zone 2e – 1’-0”
            4) Zone 3 – 1’-0”
      2) Exposed fasteners: Series 410 stainless steel fasteners or 1/8 inch diameter stainless steel waterproof rivets. All exposed fasteners shall be factory painted to match the color of the standing seam panels.
   c. Closures: Factory precut closed cell foam meeting ASTM D 1056 or ASTM D 3575, enclosed in metal channel matching panels when used at hip, ridge, rake, and jamb.
   d. Provide all miscellaneous accessories for complete installation.

2.3 STANDING SEAM METAL ROOFING ACCESSORIES

A. Underlayment:
   1. 45 mil minimum high temp self adhesive membrane, installed in accordance with manufacturer's recommendations.

B. Barrier Boards:
   1. Georgia-Pacific Corp. 1/4 inch minimum Dens-Deck protective barrier board with a Class A fire rating over deck surfaces.

C. Sealant:
   1. Concealed Applications: Non-Curing Butyl Sealant - Schnee-Morehead, Inc. SM5430 Acryl-R, or equal.
   2. Exposed Applications: UV Resistant Tripolymer Sealant - Geocel Corporation, 2300 Tripolymer Sealant, or equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive metal roofing. Notify the Architect in writing of any defective conditions encountered. Starting of work shall constitute acceptance of such conditions.

B. Structural Deck Substrate:
   1. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, and properly sloped.
   2. Verify deck is dry and joints are solidly supported and fastened.
   3. Verify wood nailers are installed and correctly located. Do not use pressure-treated wood containing salt-based preservatives or materials corrosive to steel.

C. Structural Framing Substrate:
   1. Verify primary and secondary framing members are installed and fastened, properly aligned and sloped.
   2. Verify damaged shop coatings are repaired with touch up paint.

D. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets are in place, and nailing strips located.

E. Correct defective conditions before beginning work.

3.2 INSTALLATION

A. Install in conformance with the NRCA Roofing and Waterproofing Manual and Manufacturers installation requirements.

B. Form panel shape as indicated on Drawings, accurate in size, square, and free from distortion or defects.

C. Install underlayment and eave protection sheet underlayment as recommended by the Manufacturer.

D. Coordinate with installation of rigid board insulation as specified in Division 7.

E. Install all panels continuous from ridge to eave. Transverse seams are not permitted.

F. Panel lengths that exceed maximum shipping lengths shall be field rolled on equipment owned by the panel manufacturer. Seam sealant must be factory applied.

G. Exposed fasteners, screws and/or roof mastic are unacceptable and will be rejected. System configuration only allows for exposed fasteners at panel overlap, if required, and at trim details in accordance with the Manufacturer's requirements.

H. Where not otherwise indicated conform to SMACNA details including flashings and trim.

I. Install sealants where indicated to clean dry surfaces only without skips or voids.

J. Install metal edge treatment in accordance with the manufacturer's instructions and the approved shop drawings.

K. Install metal roofing accessories in accordance with the manufacturer's instructions and the approved shop drawings.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.4 FIELD QUALITY CONTROL

A. Inspection: Provide manufacturer's field observations at start-up and at intervals of three times per week. Provide a final inspection upon completion of the Work.
   1. Warranty shall be issued upon manufacturer's acceptance of the installation.
   2. Field observations shall be performed by a Sales Representative employed full-time by the manufacturer for a minimum of 5 years and whose primary job description is to assist, inspect and approve membrane installations for the manufacturer.
   3. Provide observation reports from the Sales Representative indicating procedures followed, weather conditions and any discrepancies found during inspection.
   4. Provide a final report from the Sales Representative, certifying that the roofing system has been satisfactorily installed according to the project specifications, approved details and good general roofing practice.

THE GARLAND COMPANY, INC.

HIGH-PERFORMANCE BUILDING ENVELOPE SOLUTIONS

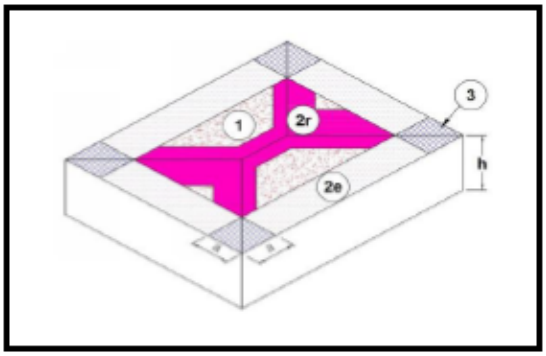
3800 EAST 91ST. STREET • CLEVELAND, OHIO 44105-2197
p. (216) 641-7500 • f. (216) 641-0633 • 800-321-9336 • www.garlandco.com

Preliminary Pressure Calculations

Date	5/17/2022
Sales Rep	Mark Humbaugh
City	Delray Beach
State	FL
Project Name	Pompey Park
Roof Sections	Pavilions

Design Code	ASCE 7-16 ASD		Base Velocity Pressure	35.9 psf	Gcpi = 0
Exposure Category	C		Roof Type	Hip	
Risk Cat. , Importance Factor	III , 1		Edge Zones		
Wind Speed	180 mph		Zone 2 width =	3'-0"	
Design Roof Height:	15		Zone 3 width =	3'-0"	
Minimum Building Width	16 ft		Zone 3 length =	3'-0"	
Roof Pitch (X, Y)	4 : 12		=		
Roof Angle	18.43 deg		=		
Parapet ≥ 36" Entire Roof	No		=		
Deck Type	Wood		Zone Image a =	3'-0"	
Deck Thickness	1 in				

Panel Type	R-Mer Span
Width	16 in
Material	0.032 Aluminum
Fastener	Wood: Concealor #12-11 GP
# per clip	2
Safety Factor	6
Clip Pry Coefficient	1.25
Ultimate Pullout	#N/A psf
Allowable Clip Load	#N/A psf
Panel Safety Factor	2



Zone Pressures (psf)

ZONE 1	ZONE 2r	ZONE 2e	ZONE 3			Wall Perimeter Zone 4	Wall Corner Zone 5
64.6	86.2	93.4	93.4			39.5	50.3
FM 1-135	FM 1-180	FM 1-195	FM 1-195				

Clip Spacing ft / in

ZONE 1	ZONE 2r	ZONE 2e	ZONE 3			Zone 4	Zone 5
3'-0"	1'-0"	1'-0"	1'-0"			#N/A	#N/A

Notes:

PER NOA No.: 17-0725.06. Using (3) fasteners per clip in zone 1 only.

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Coping

		Date	5/17/2022
		Sales Rep	Mark Humbaugh
Project Name	Pompey Park	City	Delray Beach
Roof Sections	Pavilions	State	FL

ANSI/SPRI ES-1 COPING PRELIMINARY DESIGN

Project Data

Design Wind Speed:	180	mph
Metal Edge Height:	10.00	feet
Exposure Category:	C	
Importance Classification:	III	

Design Wind Pressure ASCE 7-16 ASD

Basic Velocity Pressure:	35.91	psf
Horizontal Design Pressure:	50.27	psf
Vert. Design Pressure:	93.36	psf

ES-1 Tested Coping System

Product Designation: ES-C22-16-60-16

System Description: R-Mer Edge Snap on Coping 16" x 22 Ga w/ 16 GA Anchor Chairs at 60" o.c.

Maximum Tested Front Load:	86.1	psf
Max. Vertical Front Dim.:	6	inches
Maximum Tested Top Load:	210	psf
Max. Vertical Width:	16.00	inches
Maximum Tested Rear Load:	123.3	psf
Max. Vertical Rear Dim.:	4.00	inches

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Fascia

		Date	5/17/2022
		Sales Rep	Mark Humbaugh
Project Name	Pompey Park	City	Delray Beach
Roof Sections	Pavilions	State	FL

ANSI/SPRI ES-1 FASCIA PRELIMINARY DESIGN

Project Data

Design Wind Speed:	180	mph
Metal Edge Height:	10.00	feet
Exposure Category:	C	
Importance Classification:	III	

Design Wind Pressure ASCE 7-16 ASD

Basic Velocity Pressure:	35.91	psf
Horizontal Design Pressure:	50.27	psf

ES-1 Fascia Load

Vertical Face Dimension:	7.25	inches
Fascia Design Load:	83.96	psf

ES-1 Tested Fascia System

Product Designation: MEA-RMF-Fascia725-Z24

System Description: R-Mer Force Fascia 7.25" x 24 GA w/ RMEBF-700 Base Frame

Maximum Tested Load:	320	psf
Max. Vertical Face Dim.:	7.25	inches

END OF SECTION

SECTION 075416 - MECHANICALLY ATTACHED KETONE ETHYLENE ESTER (KEE) BASED SHEET ROOFING SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mechanically Attached Ketone Ethylene Ester (KEE) Based Sheet Roofing System.

1.2 RELATED SECTIONS

A. Section 05 30 10 - Metal Deck.

B. Section 06 10 00 - Rough Carpentry.

C. Section 07 62 00 - Flashing and Sheet Metal.

1.3 REFERENCES

A. ASTM International (ASTM):
   1. ASTM D751 – Test Methods for Coated Fabrics.
   2. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   3. ASTM D6754 - Standard Specification for Ketone Ethylene Ester Based Sheet Roofing.

B. American Society of Civil Engineers (ASCE):
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. FM Approvals (FM):
   1. FM Standard 4470 - Single-Ply, for use in Class 1 and Noncombustible Roof Deck Construction.
   2. Loss Prevention Data Sheets 1-28, 1-29.

D. FBC - Florida Building Code. 2020 – Current last edition.

E. UL - Fire Resistance Directory:
   1. UL-790 - Standard Test Method for Fire Tests of Roof Coverings.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00- Submittal Procedures.

B. Product Data:
   1. Most recent published technical literature and guide specifications issued by Membrane Roof System Manufacture (Manufacturer).
   2. Authorized Applicator's approved copy of Project Registration with Manufacturer.
   3. Preparation instructions and recommendations.
   4. Storage and handling requirements and recommendations.
   5. Typical installation methods.

6. Dimensioned shop drawings, including roof plan detailing perimeter enhancement, flashing methods, terminations, and acceptance by Manufacturer.
7. Written approval from Manufacturer confirming any accessories submitted, not manufactured or expressly approved in Manufactures literature are acceptable and compatible with the proposed FiberTite Roofing System.
8. Safety Data Sheets (SDS) relating to all products, chemicals and solvents.
9. Certification that the system specified complies with identifiable building code and insurance requirements.

C. Verification Samples: Two representative units of each type, size, pattern and color.

D. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction.

1.5 QUALITY ASSURANCE

A. Roofing Systems shall be installed only by an Applicator, authorized by Manufacturer to install Roofing Systems prior to bid or contract award. Herein, the term Authorized Applicator is synonymous with Applicator.

B. Authorized Applicator's personnel shall have received specialized training by Manufacturer.

C. Roofing Systems shall be installed in accordance with the most current guide specifications and details as amended or authorized by Manufacturer for specific project requirements.

D. There shall be no deviations from approved contract specifications or shop drawings without prior written approval by the City or Design Team and Manufacturer.

E. Unauthorized deviations may subject the roof system to warranty ineligibility.

F. Any work found to be substandard or in violation of the manufacturer's specifications shall be subject to rejection including complete removal and replacement with new materials at the expense of the Applicator.

G. A quality assurance inspection of the roof system shall be performed by Manufacturer Technical Representative (Technical Representative) for acceptance and approval. This inspection shall be performed upon completion and certification by the Applicator that the Roofing System has reached 100 percent completion, a quality installation has been completed in accordance with the approved contract specifications, and all field welds have been probed and inspected.

H. All field seams shall be visible and available to Technical Representative at the time of final inspection.

1.6 COORDINATION

A. Prior to installation of materials, a pre-roofing conference shall be held with the Authorized Applicator, and City or Design Team to discuss the specified roofing

system, coordinate its proper application and the expectations of all parties involved. The Authorized Applicator and the City or Design Team shall notify all parties a minimum of fourteen days prior to the meeting.

B. Plan and coordinate the installation of the roofing system with other trades in such a manner to avoid membrane damage, keeping the complete installation weather tight and in accordance with all approved details and warranty requirements.

C. Technical Representative shall be available to make recommendations necessary to ensure compliance with project specifications and specification alternatives due to unforeseen job conditions.

D. Provide two weeks' notice to Manufacturer, to coordinate onsite technical assistance, evaluation and, or inspections.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to the job site in manufacturer's original, unopened containers, with legible labels and in sufficient quantity to allow for continuity of work.

B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
   1. Store rolls of membrane lying down, elevated above the roof deck, and completely protected from moisture with tarpaulins. Manufacturer's packaging is not considered adequate for outdoor storage.
   2. Elevate insulation and cover board materials on pallets and fully protect from moisture with tarpaulins. Manufacturer's packaging is not considered adequate protection from moisture.
   3. Store adhesives and sealants between 50 and 80-degrees F (10 and 26.7 degrees C) prior to use.
   4. Store flammable materials in cool dry areas away from sparks and open flames.
   5. Follow all precautions as outlined in manufacturer's material safety data sheets.

C. Materials, having been determined by the City or Design Team to be damaged, shall be immediately removed from the construction site and replaced at no cost to the City.

1.8 JOB CONDITIONS

A. Safety:
   1. Take necessary precautions regarding worker health and safety when using solvents, and adhesives.
   2. Worker safety is paramount.
   3. Roof membrane can is slippery when wet, exhibits dew, frost, ice or other form of moisture.
   4. Comply with OSHA requirements for roof construction and fall protection.
   5. Store flammable liquid and materials away from open sparks, flames, and extreme heat.

6. Take necessary precautions when using solvents and adhesives.
7. Daily site cleanup to minimize debris and hazardous congestion.

B. Protection:
1. Schedule installation sequence to limit access and utilization of installed membrane for material storage, construction staging, mechanical and excessive foot traffic.
2. Provide proper protection on newly completed roofing.
3. Minimize traffic on freshly laid roofing.
4. Protect walls, rooftop units, windows, and other components during installation.

C. Additional Precautions:
1. Adverse weather conditions, e.g., extreme temperature, high winds, high humidity, and moisture, could have a detrimental effect on adhesives, general production efforts and the quality of the finished installation.
2. Daily production schedules shall be limited to what can be made 100 percent watertight at the end of each day, including flashing and night seals.
3. All surfaces to receive the new roof system, including insulation and flashing, shall be free from all dirt, debris and be thoroughly dry.
4. Comply with local EPA requirements as published by local, state and federal authorities.
5. During the construction process temporary ballast, especially in the perimeter and corner areas may be required to provide protection against high winds.

1.9 DESIGN CONDITIONS

A. Applications and project specifications require review by Manufacturer Technical Department for acceptance prior to commitment to provide a commercial warranty.

B. Manufacturer Project Registration, must be completed, signed by an Authorized Applicator, submitted to and approved by Manufacturer Technical Department.

C. Exterior Fire Test Exposure: Roof system shall achieve a FM or UL Class rating for roof slopes indicated as follows:
1. FM Approvals Class A Rating.
2. Underwriters Laboratory Class A Rating.

D. Design Requirements:
1. Uniform Wind Uplift Load Capacity:
a. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria.
1) Design Code: ASCE 7, Method 2 for Components and Cladding.
2. Dead Load:
a. Installation of new roofing materials shall not exceed the dead load capacity of the existing roof structure.

E. Sustainability: Roof system shall meet the reflectivity and emissivity criteria to qualify for one point under the FGBC credit category, SSc7.2, Heat Island Effect - Roof.

F. Roof system shall have been tested in compliance with the following codes and test requirements:
   1. Florida Building Code, FL4930-R20:
      a. System No. S-208, -60 PSF
   2. Cool Roof Rating Council:
      a. CRRC Directory CRRC 0634.
   3. Underwriters Laboratories:
      a. Certification TGFU.R 10117.

1.10 WARRANTY

A. Furnish the City with a Twenty-Five (25) Year Full System Material and Labor Warranty, not pro-rated, covering the cost of repairing leaks as a direct result of either defects in the membrane or the workmanship involved in its installation.

B. Provide contractor's warranty covering leaks caused by material defects and or installation workmanship for a period of Five (5) years.

C. Maintenance Requirements: A set of instructions included detailing preventative maintenance requirements on the part of the City and noting a list of harmful substances that may damage the FiberTite membrane.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: FiberTite, Seaman Corporation, which is located at: 1000 Venture Boulevard; Wooster, OH 44691-9360; Toll Free Tel: 800-927-8578; Tel: 330-262-1111; Fax: 800-649-2737 Email: (marketing@seamancorp.com); Web: https://www.fibertite.com

2.2 MEMBRANE

A. Standards of Compliance: ASTM D6754 - 15 Standard Specification for Ketone Ethylene Ester (KEE) Based Sheet Roofing.

B. Physical Properties: See associated ASTM D6754 data sheets.

C. FiberTite Membranes:
   1. FiberTite-XT 50-mil Membrane: Nominal 50 mil (1.27 mm) ketone ethylene ester (KEE) membrane reinforced with 6.5 oz per sq. yd (220.4 grams per sq. m) knitted polyester fabric.
   2. Standard Color

D. Flashing Membranes:
   1. Requirements to match field membrane and warranty expectations selected for roofing system.

a. FiberTite-XT Nominal 50 mil (1.27 mm).
b. Standard Color

2.3 ANCILLARY MATERIALS

A. Flashing Adhesive:
1. Alpha-Tite: VOC compliant solvent borne, contact (two-sided) bonding adhesive for bonding smooth-back FiberTite membranes to properly prepared and preauthorized horizontal and vertical substrates.
2. FTR-190e: VOC compliant solvent borne, contact (two-sided) bonding adhesive, for bonding smooth-back FiberTite membranes to properly prepared and preauthorized horizontal and vertical substrates.

B. Fasteners:
1. Securing membranes to steel, wood and structural concrete decks.
   a. FiberTite MAGNUM Series: No. 15-13, buttress threaded, No. 3 Phillips head fastener constructed of case-hardened carbon steel with a reduced diameter drill point and corrosion resistant coating.
2. Securing insulation to steel.
   a. FiberTite-HD: No. 14-13, heavy duty threaded steel No. 3 Phillips truss, self-tapping corrosion resistant fastener.

C. FTR Stress Plates: Used to anchor membranes.
1. FTR Magnum Plus: 1.5 x 2.75 inch (38 x 70 mm) Barbed Rectangular Stress Plate with radial corners; 18-gauge AZ-50 galvalume steel.
2. FTR Magnum R275: 2.75 inch (70 mm) Barbed Round Stress Plate; 20-gauge galvanized steel.
3. FTR Magnum 2S: 2.375 inch (60 mm) Barbed Round Stress Plate; 20-gauge galvanized steel.
4. FTR 3-inch (76 mm) Metal Round Insulation Stress Plates: Finish: AZ-50 galvalume. Flat and flush profile for use on rigid board surfaces.

D. Additional Components:
1. Flashing Terminations Sealant: FTR-101. Single-component gun-grade polyether.
2. Sealant for Pitch Pans: FTR-SLS Sealant. Single -component self-leveling polyether.
3. Fabricated Metal Flashing: FiberClad Metal. 48 x 120-inch (1219 x 3048 mm) sheets.
   a. Material: Steel. 24-gauge hot dipped G-90 laminated with a 0.02 inch (0.0005 mm) polymeric coating.
   b. Material: Aluminum 300 H14. 0.040 inch (1.02 mm) thick laminated with a 0.02 inch (0.0005 mm) polymeric coating.
4. FTR Pre-molded Flashings: Injection molded vent stack, split Wrapid Flash and inside and outside corner flashing using FiberTite vinyl compound.
5. FTR Non-Reinforced Membrane: Field fabrication membrane, 60 mil (1.5 mm) non-reinforced vinyl membrane.
6. Walkway and Protection Pads: FTR-Tuff Track. High grade walkway and protection material with slip-resistant design.

7. FTR-Termination Bar: Membrane flashings restraint and termination seals. 0.125 x 1 x 120 inch (3 x 25 x 3048 mm) 6060-T5 extruded aluminum bar with pre-punched slots, 8 inches (203 mm) on center.
8. FiberTite Metal Fascia System: Two piece "snap-on" pre-formed, architectural Kynar metal edge systems.
9. FTR-Value Insulation: Polyisocyanurate and extruded polystyrene flat or tapered insulation.
10. FiberTite Seam Cleaner: FiberTite Seam Cleaner is to be used with clean white cotton cloths or rags to clean contamination from the seam areas of the membrane prior to welding.
11. FTR T Joint Covers: Pre-cut 4 x 4 inch (102 x 102 mm) 60 mil (1.5 mm) non-reinforced membrane to reinforce areas where three overlapping sheets of membrane intersect.

2.4 INSULATION

A. Insulation shall be installed, where specified or required to provide a suitable surface for the Roofing Systems and meet desired thermal values.

B. Products must be pre-approved in writing by Manufacturer and comply with minimal characteristics and classification listed for the products below:
1. Polyisocyanurate Rigid Insulation:
a. ASTM C1289 Type II, Class1, Grade 2: with an R-Value of 30
1) FTR-Value Brand Polyisocyanurate Rigid Insulation.
2) Atlas Roof Insulation, ACFoam II
3) Hunter Panels, H-Shield
2. XPS Rigid Insulation (ASTM D1621): with an R-Value of 30
a. FTR-Value Brand XPS Rigid Insulation.
b. Approved alternates.

2.5 RELATED MATERIALS

A. Wood Nailers: No. 2 or better construction grade lumber.
1. Installation of other types of treated lumber should be verified with a design professional.
2. Creosote or asphaltic type preservatives are not acceptable.
3. Top Nailer Thickness: 1.5 inches (38 mm) minimum.

PART 3 EXECUTION

3.1 GENERAL

A. Authorized Applicator: Ensure strict compliance with Manufacturers General Guide Specifications for Installation of Roofing Systems.
1. Provide suitable substrate surface for proper installation of roofing system, roof insulation and specified components.
2. Coordinate installation ensuring system remains watertight at end of each working day.

3.2 SUBSTRATE PREPARATION

A. Authorized Applicator: Verify the deck condition is suitable for the specified installation.

B. Examine surfaces for inadequate anchorage, low areas that will not drain properly, foreign material, ice, wet insulation, unevenness, or any other defect which would prevent the proper execution and quality application roofing system as specified.

C. Prepared substrate shall be smooth, dry, and free of debris or any other irregularities which would interfere with proper installation.

D. Do not proceed with any part of the application until all defects and preparation work have been corrected and complete.

3.3 WOOD NAILERS

A. Install treated lumber at same heights as insulation layer or adjacent construction plus or minus 0.25 inch (6 mm). Install continuous treated wood nailers at all perimeters, around roof projections and penetrations as shown in approved details.

B. Wood Nailers Installed Directly on the Substrate: Carefully examine substrates to confirm the entire area provides a suitable fastening surface. Repair defects by appropriate trades prior to installation.

C. Nailers (W x H): Minimum 3.5 x 1.5 inches (89 x 38 mm). Installed and anchored in such a manner to resist a force of 250 lbs per linear foot (2.919 kN per m) of wood blocking in any direction.

D. Nailers along parapets, curbs and expansion joints are recommended for insulated decking. Consult FiberTite Construction Details or FiberTite Technical Services for optional, alternate membrane termination, and securement methods.

3.4 ROOF INSULATION INSTALLATION

A. General:
   1. Roof insulation shall be installed whereby the long dimension of the boards run in parallel alignment and the short dimensions are staggered.
   2. Insulation shall be installed with minimum joint dimensions and shall be tightly butted where possible. Maximum joint widths shall be 0.375 inch (9.5 mm). Damaged corners shall be cut out and replaced with an insulation piece a minimum of 12 x 12 inch (305 x 305 mm). Pieces that are cut from larger panels and are smaller than one square foot are not acceptable.
   3. Install no more than can be covered during the same working day.
   4. Taper roof insulation to drain sumps using tapered edge strips. If an insulation layer is 1.5 inches (38 mm) or less, taper 12 inches (305 mm) from the drain bowl. If insulation thickness exceeds 1.5 inches (38 mm), taper 18 inches (457 mm) from the drain bowl. All taper boards or pieces must be adhered or mechanically fastened with a minimum of two fasteners per board.
   5. When multiple layers are installed each layer shall be offset from the previous layer a minimum of 12 inches (305 mm) on center.

6. At the end of each working day, provide a watertight cover on all unused insulation as to avoid moisture penetration.

B. Preliminary Attachment of Insulation for Mechanically Attached Roofing Systems:
   1. Insulation shall be applied to or installed over properly prepared and preapproved substrates, free of any debris, dirt, grease, oil or moisture.
   2. All fasteners and stress plates for the mechanical attachment of insulation and cover board materials shall be FTR Fasteners as provided by Seaman Corporation.
   3. All fasteners and stress plates shall be FM approved for mechanical attachment of insulation and comply with FM Standard 4470 for corrosion resistance.
   4. General 1-90 attachment criteria require preliminary attachment for insulation and cover boards for mechanically attached membrane roofing systems. Insulation and cover board within the field of the roof requires 6 fasteners and stress plates per 48 x 96 inches (1219 x 2348 mm) insulation board.
   5. Perimeter areas do not require an increase in the fastener density when the membrane is mechanically attached.
   6. Corner areas do not require an increase in the fastener density when the membrane is mechanically attached.
   7. Fasteners shall be installed straight, tight and perpendicular to the decking complying with minimum penetration requirements of specific deck types. Do not over torque fasteners.
   8. Fasteners shall be installed using depth sensing tool attachments to ensure proper installation.

3.5 INSTALLATION OF MEMBRANES

A. Quality Control:
   1. It is the responsibility of the Authorized Applicator to initiate and maintain a Quality Control program to govern all aspects of the installation.
   2. The project foreman and or supervisor will be responsible for the daily execution of the Quality Control program which will include but is not limited to the supervision, inspection and probing of all heat welded seams incorporated within roofing system.
   3. If inconsistencies in quality of the application of the composite, membrane or welds are found, work shall cease until corrective actions are taken to ensure the continuity of the installation.

B. General:
   1. Coordinate work ensuring that sequencing of installation promotes a 100 percent watertight installation at the end of each day.
   2. Roofing systems to be designed utilizing and determined to be in compliance with the procedures outlined within the current publication of ASCE 7.

Alternative designs may be determined using the criteria within FM Loss Prevention Data.

3. Restrictions regarding outside ambient air temperature are relative only to the exposure limits of the workers or adhesives when necessary.
4. Roofing systems shall only be installed over properly prepared and sound substrates, free from excessive surface roughness, dirt, debris and moisture.

C. Roof Membrane Mechanically Attached (Class 1 Decks):
1. Rolls of roof membrane are to be positioned and installed straight and snug but not taut. Stretching of the membrane places undue stress on the mechanical fasteners.
2. The properly positioned membrane shall be attached using Approved Fasteners and Membrane Stress Plates installed through the membrane and insulation assembly and engage the structural decking.
3. The membrane stress plates shall be installed straight and parallel to existing structural purlin members. All stress plates must set completely on the membrane allowing a minimum of 0.5 inch (13 mm) from the edge and allow sufficient room to facilitate welding.
4. Fastener row spacing, and intervals shall be established to resist design pressures, determined in compliance with procedures outlined within the current publication of ASCE Standard 7. Alternative designs may be determined using the criteria within Factory Mutual Research Loss Prevention Data.
5. Table MA 01/21-1 lists general default attachment requirements for the field of the roof, as applied to structural roof decks referred to as Class 1; minimum 3/4-inch (19 mm) plywood, minimum 22-gauge steel or minimum 3,000 psi (20684 kPa) concrete.
6. Perimeter zone and corner zone, as defined by Building Code, enhancement is required on all mechanically fastened roofing systems.
7. Projects having variable roof levels shall treat the outer boundary of each level as a perimeter. Internal expansion joints, firewalls or adjoining building walls greater than 3 feet (914 mm) are not considered perimeter areas.
8. Perimeters and corners may be enhanced by:
    a. Installing half rolls of membrane fastened as prescribed by project requirements.
    b. Adding additional rows of fasteners through the top of the membrane system within the perimeter at prescribed intervals area and sealing with a 6-inch (152 mm) strip.

D. Welding:
1. General:
    a. Field seams exceeding 10 ft (3048 mm) in length shall be welded with an approved automatic welder.
    b. Field seams must be clean and dry prior to initiating any field welding.
    c. Remove foreign materials from the seams (dirt, oils, etc.) with Manufacturer supplied Seam Cleaner or authorized alternative.
    d. Use clean white cotton cloths and allow approximately five minutes for solvents to dissipate before initiating the automatic welder. Do not use denim or synthetic rags for cleaning.

e. Welding shall be performed only by qualified personnel to ensure the quality and continuity of the weld.
f. Contaminated areas within a seam will inhibit proper welding and will require a membrane patch or strip.

2. Hot Air Hand Welding:
   a. The lap or seam area of the membrane may be intermittently tack welded to hold the membrane in place.
   b. The back, interior edge of the membrane shall be welded first, with a thin, continuous weld to concentrate heat along the exterior edge of the lap during the final welding pass.
   c. The nozzle of the handheld hot air welder shall be inserted into the lap at a 45-degree angle to the lap. Once the polymer on the material begins to flow, a hand roller shall be used to apply pressure at a right angle to the tip of the hand welder. Properly welded seams shall utilize a 1.5 inch (38 mm) wide nozzle, to create a homogeneous weld, a minimum of 1.5 inch (38 mm) in width.
   d. Smaller nozzles may be used for corners, and another field detailing, maintaining a minimum 1-inch (25 mm) weld.
3. Automatic Hot Air Machine Welding:
   a. Follow all manufacturers' instructions for the safe operation of the automatic welder.
   b. Follow local code requirements for electric supply, grounding and surge protection.
   c. The use of a dedicated, portable generator is highly recommended to ensure a consistent electrical supply, without fluctuations that can interfere with weld consistency.
   d. Properly welded seams shall utilize a 1.5 inch (38 mm) wide nozzle, to create a homogeneous weld, a minimum of 1.5 inch (38 mm) in width.

E. Inspection:
1. The job foreman or supervisor shall initiate daily inspections of all completed work which shall include but is not limited to, the probing of all field welding with a dull pointed instrument to assure the quality of the application and ensure that any equipment or operator deficiencies are immediately resolved.
2. Ensure all aspects of installation (sheet layout, attachment, welding, flashing details, etc.) are in strict accordance with the most current Manufacturer Roofing Systems Specifications and Details.
3. Excessive patching of field seams because of inexperienced or poor workmanship will not be accepted at time of Final Inspection for Warranty Acceptance.
4. Any deviation from pre-approved specifications and details requires written authorization from the FTS prior to application to avoid any warranty disqualification.
5. It is the Applicator, job foreman, supervisor, or quality control personnel's responsibility to perform a final self-inspection on all seams prior to requesting the inspection for warranty issuance by the FTS.

F. T-Joint Cover Installation:

1. Installation of T-Joint Covers is mandatory where T-Joints have not been properly sealed to exhibit a minimum 1.5 inch (38 mm) defined crease along the T-Joint.
2. Install T-Joint Covers, centered and aligned so edges are parallel to roof system seams.
3. The T-Joint Cover shall be 100 percent welded.

3.6 FLASHING

A. Adhesives
1. When using adhesives outside ambient air temperature shall be above 40 degrees F (4.4 degrees C). Curing or drying time of the adhesive will be affected by ambient temperatures and must be taken into consideration.
2. Humidity can affect the drying time of solvent borne adhesives or cause condensation to form on the newly applied adhesive.
3. No moisture may be present on the adhesives prior to mating or application of membranes.

B. Clean vents, pipes, conduits, tubes, walls, and stacks to bare metal. Protrusions must be properly secured to roof deck with approved fasteners. Remove and discard lead pipes and drain flashing. Flash penetrations according to approved details.

C. Remove loose or deteriorated cant strips and flashings.

D. Flash curbs, parapets and interior walls in strict accordance with approved Manufacturer details.

E. All flashing shall be adhered to properly prepared, approved substrates with Alpha-Tite bonding adhesive. FTR-190e bonding adhesive applied in sufficient quantity to ensure total adhesion.

F. The base flange of all membrane flashing shall extend out on to the plane of the deck, beyond the wood nailers to a maximum width of 8 inches (203 mm).

G. Vertical flashing shall be terminated no less than 8 inches (203 mm) above the plane of the deck with approved termination bar and counter-flashing or metal cap flashing.

H. When using FTR-201 as the adhesive, vertical wall flashing termination shall not exceed 40 inches (1016 mm) without supplemental mechanical attachment of the flashing between the deck and the termination point of the flashing.

I. Complete all inside and outside corner flashing details with Manufacturer preformed corners or an approved field fabrication detail.

J. Probe all seams with a dull, pointed probe to ensure the weld has created a homogeneous bond.

K. Install penetration accessories in strict accordance with approved details. Ensure penetration accessories have not impeded in any way the working specification. Refer to the related trade for the technical specification.

3.7 METAL FLASHING

A. Ensure all fascia extend a minimum of 2 inches (51 mm) lower than the bottom of the wood nailers.

B. Fasten all metal flashing to wood nailers or approved substrate with approved fasteners per manufacturers detailed drawings.

C. Break and install clad metal in accordance with approved details, ensuring proper attachment, maintaining 1/2-inch (13 mm) expansion joints and the installation of a minimum 2-inch bond breaker tape prior to sealing the joint.

D. Solidly weld clad Metal expansion joints with a 6-inch (152 mm) strip of roof membrane welded to the clad Metal, covering the bond breaker tape (cover plates are optional).

E. Roof Drains:
   1. Flash all roof drains in accordance with Manufacturer roof drain details.
   2. Replace all worn or broken parts that may cut the roof membrane or prevent a watertight seal. This includes the clamping ring and strainer basket.
   3. Replace all drain bolts or clamps used to hold the drain compression ring to the drain bowl.
   4. Non-reinforced 60 mil (1.52 mm) membrane shall be used for flashing the drain assembly. Drain assemblies and basins or sumps must be free of any asphalt or coal tar pitch residue prior to installation.
   5. The drain target sheet should be sized and installed to provide for a minimum of 12 inches (203 mm) of exposed 60 mil (1.52 mm) on all sides of the drain.

F. Pitch Pans:
   1. Every reasonable effort shall be made to eliminate the need for pitch pans. Contact FTS for specific design alternatives and recommendations.
   2. Pitch Pans and the sealant will require periodic maintenance by the City's maintenance personnel.

3.8 EXPANSION JOINTS

A. Flash all expansion joints in accordance with authorized details. Fasten all expansion joint material according to manufacturer specifications. Ensure the expansion material has sufficient material to expand to the widest point in expansion without causing undue stress on the expansion joint material.

B. If the expansion joint is a preformed system, the manufacturer, description and a drawing illustrating the method of installation must be included when the Project Registration is submitted.

3.9 SEALANTS

A. Apply authorized sealants to all surface mounted reglets and per project requirements. Sealants are to shed water. Follow all manufacturer's instructions and installation guides.

B. Use primer when recommended by the manufacturer.

C. Sealants will require periodic maintenance by the City's maintenance personnel.

3.10 TEMPORARY SEALS

A. At the end of each working day or at the sign of rain, install temporary, 100 percent watertight seals where the completed new roofing adjoins the uncovered deck or existing roof surface.

B. The Authorized Applicator shall create and maintain the temporary seal in such a manner to prevent water from traveling beneath the new or existing roof system.

C. The use of plastic roofing cement is permissible when sealing to an existing built up roof.

D. If water is allowed to enter beneath the newly completed roofing, the affected areas shall be removed and replaced at no additional expense to the City.

E. Prior to the commencement of work, cut out and remove all contaminated membrane, insulation, roof cement or sealant and properly dispose of offsite.

3.11 WALKWAYS

A. Walkways and protection pads shall be installed at staging areas for rooftop equipment maintenance or areas subject to regular foot traffic.

B. Walkway Installation:
1. Roofing membrane to receive walkway material shall be clean and dry.
2. Cut and position the Walkway material as directed by the specifications or agreement.
3. Hot air weld, the entire perimeter of the walk way to the previously cleaned roofing membrane. Avoid excessive heating of the walk way material to prevent scorching the underlying roofing membrane.

3.12 LIGHTNING PROTECTION

A. The installation of lightning protection must be coordinated with the Authorized Applicator, certified lightning contractor and the City.

B. The lightning protection must be installed in such a manner that base plates, air terminals and cables do not penetrate the roofing membrane without the use of pre-approved flashing details.

C. Cables and air terminals may be attached to the membrane using base plates and FTR-101 sealant. Contact FTS for specific adhesive recommendations.

3.13 COMPLETION

A. Remove any and all debris, excess materials and scrap of any kind from the roof and surrounding premises prior to demobilization.

B. Inspect all field welds, detailing and terminations to ensure a 100 percent watertight installation.

3.14 FINAL INSPECTION FOR WARRANTY

A. Upon completion of the project, the Authorized Applicator shall register the completion of the project with Manufacturer Technical Department. Upon notice of completion, an FTS representative will schedule an inspection with a representative of the Authorized Applicator to thoroughly review the installation and verify compliance with Seaman Corporation specifications.

B. Any corrections or modifications necessary for compliance with the specifications and acceptance for warranty (punch list) will be noted on the Final Inspection for Warranty Form.

3.15 SUBSTITUTIONS

Or approved equal with matching quantities, finishes, accessories & warranties.

END OF SECTION

SECTION 075416.1 - ADHERED KETONE ETHYLENE ESTER (KEE) BASED SHEET ROOFING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Adhered Ketone Ethylene Ester (KEE) Based Sheet Roofing Systems.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 06 10 00 - Rough Carpentry.

C. Section 07 62 00 - Flashing and Sheet Metal.

1.3 REFERENCES

A. ASTM International (ASTM):
   1. ASTM D6754 - Standard Specification for Ketone Ethylene Ester Based Sheet Roofing.
   2. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   3. ASTM D751 – Test Methods for Coated Fabrics.

B. American Society of Civil Engineers (ASCE):
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. FM Approvals (FM):
   1. FM Standard 4470 - Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction.
   2. Loss Prevention Data Sheets 1-28, 1-29.

D. FBC - Florida Building Code.

E. UL - Fire Resistance Directory.
   1. UL-790 - Standard Test Method for Fire Tests of Roof Coverings.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data:
   1. Most recent published technical literature and guide specifications issued by Membrane Roof System Manufacture (Manufacturer).
   2. Authorized Applicator's approved copy of Project Registration with Manufacturer.
   3. Preparation instructions and recommendations.
   4. Storage and handling requirements and recommendations.
   5. Typical installation methods.

6. Dimensioned shop drawings, including roof plan detailing perimeter enhancement, flashing methods, terminations, and acceptance by Manufacturer.
7. Written approval from Manufacturer confirming any accessories submitted, not manufactured or expressly approved in Manufactures literature are acceptable and compatible with the proposed FiberTite Roofing System.
8. Safety Data Sheets (SDS) relating to all products, chemicals and solvents.
9. Certification that the system specified complies with identifiable building code and insurance requirements.

C. Verification Samples: Two representative units of each type, size, pattern and color.

D. Shop Drawings: Include details of materials, construction and finish. Include relationship with adjacent construction.

1.5 QUALITY ASSURANCE

A. Roofing Systems shall be installed only by an Applicator, authorized by Manufacturer to install Roofing Systems prior to bid or contract award. Herein, the term Authorized Applicator is synonymous with Applicator.

B. Authorized Applicator's personnel shall have received specialized training by Manufacturer.

C. Roofing Systems shall be installed in accordance with the most current guide specifications and details as amended or authorized by Manufacturer for specific project requirements.

D. There shall be no deviations from approved contract specifications or shop drawings without prior written approval by the City or Design Team and Manufacturer.

E. Unauthorized deviations may subject the roof system to warranty ineligibility.

F. Any work found to be substandard or in violation of the manufacturer's specifications shall be subject to rejection including complete removal and replacement with new materials at the expense of the Applicator.

G. A quality assurance inspection of the roof system shall be performed by Manufacturer Technical Representative (Technical Representative) for acceptance and approval. This inspection shall be performed upon completion and certification by the Applicator that the Roofing System has reached 100 percent completion, a quality installation has been completed in accordance with the approved contract specifications, and all field welds have been probed and inspected.

H. All field seams shall be visible and available to Technical Representative at the time of final inspection.

1.6 COORDINATION

A. Prior to installation of materials, a pre-roofing conference shall be held with the Applicator, and City or Design Team to discuss the specified roofing system, coordinate its proper application and the expectations of all parties involved. The

Authorized Applicator and the City or Design Team shall notify all parties a minimum of fourteen days prior to the meeting.

B. Plan and coordinate the installation of the roofing system with other trades in such a manner to avoid membrane damage, keeping the complete installation weather tight and in accordance with all approved details and warranty requirements.

C. Technical Representative shall be available to make recommendations necessary to ensure compliance with project specifications and specification alternatives due to unforeseen job conditions.

D. Field services are provided at the discretion of Seaman Corporation. A minimum two weeks' notice is required to evaluate and coordinate any request for onsite technical assistance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to the job site in manufacturer's original, unopened containers, with legible labels and in sufficient quantity to allow for continuity of work.

B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
   1. Store rolls of membrane lying down, elevated above the roof deck and completely protected from moisture with tarpaulins. Manufacturer's packaging is not considered adequate for outdoor storage.
   2. Elevate Insulation and cover board materials on pallets and fully protect from moisture with tarpaulins. Manufacturer's packaging is not considered adequate protection from moisture.
   3. Store adhesives and sealants between 50 and 80-degrees F (10 and 26.7 degrees C) prior to use.
   4. Store flammable materials in cool dry areas away from sparks and open flames.
   5. Follow all precautions as outlined in manufacturer's material safety data sheets.

C. Materials, having been determined by the City or Design Team to be damaged, shall be immediately removed from the construction site and replaced at no cost to the City.

1.8 JOB CONDITIONS

A. Safety:
   1. Take necessary precautions regarding worker health and safety when using solvents, adhesives or hot asphalt.
   2. Worker safety is paramount.
   3. Roof membrane is slippery when wet, exhibits dew, frost, ice or other form of moisture.
   4. Comply with OSHA requirements for roof construction and fall protection.
   5. Store flammable liquid and materials away from open sparks, flames and extreme heat.
   6. Take necessary precautions when using solvents and adhesives.

7. Daily site cleanup to minimize debris and hazardous congestion.

B. Protection:
   1. Schedule installation sequence to limit access and utilization of installed membrane for material storage, construction staging, mechanical and excessive foot traffic.
   2. Provide proper protection on newly completed roofing.
   3. Minimize traffic on freshly laid roofing.
   4. Protect walls, rooftop units, windows and other components during installation.

C. Additional Precautions:
   1. Adverse weather conditions, e.g. extreme temperature, high winds, high humidity and moisture, could have a detrimental effect on adhesives, general production efforts and the quality of the finished installation.
   2. Daily production schedules shall be limited to what can be made 100 percent watertight at the end of each day, including flashing and night seals.
   3. All surfaces to receive the new roof system, including insulation and flashing, shall be free from all dirt, debris and be thoroughly dry.
   4. Comply with local EPA requirements as published by local, state and federal authorities.
   5. During the construction process temporary ballast, especially in the perimeter and corner areas may be required to provide protection against high winds.

1.9 DESIGN CONDITIONS

A. Applications and project specifications require review by Manufacturer Technical Department for acceptance prior to commitment to provide a commercial warranty.

B. Manufacturer Project Registration, must be completed, signed by an Authorized Applicator, submitted to and approved by Manufacturer Technical Department.

C. Exterior Fire Test Exposure: Roof system shall achieve a FM or UL Class rating for roof slopes indicated as follows:
   1. FM Approvals Class A Rating.
   2. Underwriters Laboratory Class A Rating.

D. Design Requirements:
   1. Uniform Wind Uplift Load Capacity
      a. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria.
         1) Design Code: ASCE 7, Method 2 for Components and Cladding.
   2. Dead Load:
      a. Installation of new roofing materials shall not exceed the dead load capacity of the existing roof structure.

E. Sustainability: Roof system shall meet the reflectivity and emissivity criteria to qualify for one point under the FGBC credit category, SSc7.2, Heat Island Effect - Roof.

F. Roof system shall have been tested in compliance with the following codes and test requirements:
   1. Florida Building Code, FL4930-R20:
      a. System No. C-4, -232.5 PSF
   2. Cool Roof Rating Council:
      a. CRRC Directory CRRC 0634.
   3. Underwriters Laboratories:
      a. Certification TGFU.R 10117.

1.10 WARRANTY

A. Furnish the City with a Twenty-Five (25) Year Full System Material and Labor Warranty, not pro-rated, covering the cost of repairing leaks as a direct result of either defects in the membrane or the workmanship involved in its installation.

B. Provide contractor's warranty covering leaks caused by material defects and or installation workmanship for a period of Five (5) years.

C. Maintenance Requirements: A set of instructions included detailing preventative maintenance requirements on the part of the City and noting a list of harmful substances that may damage the roof membrane.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: FiberTite, Seaman Corporation, which is located at: 1000 Venture Boulevard; Wooster, OH 44691-9360; Toll Free Tel: 800-927-8578; Tel: 330-262-1111; Fax: 800-649-2737 Email: (marketing@seamancorp.com); Web: https://www.fibertite.com

2.2 MEMBRANE

A. Standards of Compliance: ASTM D6754 - 15 Standard Specification for Ketone Ethylene Ester (KEE) Based Sheet Roofing.

B. Physical Properties: See associated ASTM D6754 data sheets.

C. FiberTite Membranes:
   1. FiberTite-XT 50-mil Membrane: Nominal 50 mil (1.27 mm) ketone ethylene ester (KEE) membrane reinforced with 6.5 oz per sq. yd (220.4 grams per sq. m) knitted polyester fabric.
   2. Standard Color

D. Flashing Membranes:
   1. Requirements to match field membrane and warranty expectations selected for roofing system.
      a. FiberTite-XT Nominal 50 mil (1.27 mm).
      b. Standard Color

2.3 ANCILLARY MATERIALS

A. Membrane Adhesives:
   1. Alpha-Tite: VOC compliant solvent borne, contact (two-sided) bonding adhesive for bonding smooth-back FiberTite membranes to properly prepared and preauthorized horizontal and vertical substrates.
   2. FTR-190e: VOC compliant solvent borne, contact (two-sided) bonding adhesive, for bonding smooth-back membranes to properly prepared and preauthorized horizontal and vertical substrates.

B. Flashing Adhesives:
   1. Alpha-Tite: VOC compliant solvent borne, contact (two-sided) bonding adhesive for bonding smooth-back membranes to properly prepared and preauthorized horizontal and vertical substrates.
   2. FTR-190e: VOC compliant solvent borne, contact (two-sided) bonding adhesive, for bonding smooth-back membranes to properly prepared and preauthorized horizontal and vertical substrates.

C. Fasteners:
   1. Securing membranes to structural concrete decks.
      a. FiberTite MAGNUM Series: No. 15-13, buttress threaded, No. 3 Phillips head fastener constructed of case-hardened carbon steel with a reduced diameter drill point and corrosion resistant coating.
   2. Securing insulation to concrete decks.
      a. FiberTite-HD: No. 14-13, heavy duty threaded steel No. 3 Phillips truss, self-tapping corrosion resistant fastener.

D. FTR Stress Plates: Used to anchor membranes.
   1. FTR Magnum Plus: 1.5 x 2.75 inch (38 x 70 mm) Barbed Rectangular Stress Plate with radial corners; 18 gauge AZ-50 galvalume steel.

E. Additional Components:
   1. Flashing Terminations Sealant: FTR-101. Single-component gun-grade polyether.
   2. Sealant for Pitch Pans: FTR-SLS Sealant. Single -component self-leveling polyether.
   3. Fabricated Metal Flashing: FiberClad Metal. 48 x 120-inch (1219 x 3048 mm) sheets.
      a. Steel: 24-gauge hot dipped G-90.
      b. Aluminum 300H14: 0.040 inch (1.02 mm) thick laminated with a 0.02 mil (0.0005 mm) polymeric coating. (Can be painted with FTB-Kynar Primer followed by FTB-Kynar Touch Up Paint.)
   4. FTR Pre-molded Flashings: Injection molded vent stack, split Wrapid Flash and inside and outside corner flashing using membrane vinyl compound.
   5. FTR Non-Reinforced Membrane: Field fabrication membrane, 60 mil (1.5 mm) non-reinforced vinyl membrane.
   6. FTR-Termination Bar: Membrane flashings restraint and termination seals. 0.125 x 1 x 120 inch (3 x 25 x 3048 mm) 6060-T5 extruded aluminum bar with pre-punched slots, 8 inches (203 mm) on center.
   7. FTR-Value Insulation: Polyisocyanurate and extruded polystyrene flat or tapered insulation.

8. FTR-601 & FTR-601 PG: Dual component, single bead (ribbon applied) urethane insulation adhesive. Adhesive is a non-solvent, elastomeric, urethane adhesive, specifically designed for bonding single or multiple layers of roof insulation and insulation composites or cover boards to structural roof decks and base sheets.
9. Seam Cleaner: Seam Cleaner is to be used with clean white cotton cloths or rags to clean contamination from the seam areas of the membrane prior to welding.
10. FTR T Joint Covers: Pre-cut 4 x 4 inch (102 x 102 mm) 60 mil (1.5 mm) non-reinforced membrane to reinforce areas where three overlapping sheets of membrane intersect.

2.4 INSULATION

A. Insulation shall be installed, where specified or required to provide a suitable surface for the Roofing Systems and meet desired thermal values.

B. Products must be pre-approved in writing by Manufacturer and comply with minimal characteristics and classification listed for the products below:
   1. Polyisocyanurate Rigid Insulation:
      a. ASTM C1289 Type II, Class1, Grade 2: with an R-Value of 30
         1) FTR-Value Brand Polyisocyanurate Rigid Insulation.
         2) Atlas Roof Insulation, ACFoam II
         3) Hunter Panels, H-Shield
   2. XPS Rigid Insulation (ASTM D1621): with an R-Value of 30
      a. FTR-Value Brand XPS Rigid Insulation.
      b. Approved alternates.

2.5 RELATED MATERlALS

A. Wood Nailers: No. 2 or better construction grade lumber.
   1. Installation of other types of treated lumber should be verified with a design professional.
   2. Creosote or asphaltic type preservatives are not acceptable.
   3. Top Nailer Thickness; 1.5 inches (38 mm) minimum.

PART 3 EXECUTION

3.1 GENERAL

A. Authorized Applicator: Ensure strict compliance with Manufacturers General Guide Specifications for Installation of Roofing Systems.
   1. Provide suitable substrate surface for proper installation of roofing system, roof insulation and specified components.
   2. Coordinate installation ensuring system remains watertight at end of each working day.

B. Application of roofing materials constitutes an agreement that Authorized Applicator has inspected and found the substrate suitable for installation of roofing system.

3.2 SUBSTRATE PREPARATION

A. Authorized Applicator: Verify the deck condition or existing roof construction is suitable for the specified installation.

B. Examine surfaces for inadequate anchorage, low areas that will not drain properly, foreign material, ice, wet insulation, unevenness or any other defect which would prevent the proper execution and quality application roofing system as specified.

C. Prepared substrate shall be smooth, dry, and free of debris or any other irregularities which would interfere with proper installation.

D. The application of adhesives or hot asphalt directly to structural concrete, gypsum, Tectum, lightweight insulating concrete, existing smooth or granulated BUR materials may require sealing or priming with an appropriate elastomeric or asphalt primer prior to application.

E. Adhesives will not bond to wet, damp or inadequately cured lightweight insulating concrete or poured structural concrete.

F. Do not proceed with any part of the application until all defects and preparation work have been corrected and complete.

3.3 SUBSTRATE PREPARATION (NEW CONSTRUCTION)

A. Structural Concrete
   1. Decking shall be installed in strict conformance with industry standards, practices and/or pre-cast panel manufacturer's installation requirements.
   2. Decking shall be installed to provide positive slope and subsequent positive drainage of the new Adhered Roofing Systems.
   3. Finished decking shall be properly cured and dried prior to the installation of approved insulation.
   4. Finished surfaces to receive new roof system shall be smooth and level without significant surface depressions or irregularities. Camber differentials greater than 3/16 inch (5 mm) must be leveled using a cementitious grout.
   5. Finished surfaces shall be dry, free of moisture, dust, loose debris and any other irregularities that may hinder the proper performance of the new Roofing Systems.

3.4 WOOD NAILERS

A. Install treated lumber at same heights as insulation layer or adjacent construction plus or minus 0.25 inch (6 mm). Install continuous treated wood nailers at all perimeters, around roof projections and penetrations as shown in approved details.

B. Wood Nailers Installed Directly on the Substrate: Carefully examine substrates to confirm the entire area provides a suitable fastening surface. Repair defects by appropriate trades prior to installation.

C. Nailers (W x H): 3.5 x 1.5 inches (89 x 38 mm). Installed and anchored in such a manner to resist a force of 250 lbs per linear foot (2.919 kN per m) of wood blocking in any direction.

3.5 ROOF INSULATION INSTALLATION

A. General:
   1. Insulation Boards: Adhered in approved adhesives. Maximum 4 x 4 ft (1219 x 1219 mm).
   2. Install insulation with minimum joint dimensions and tightly butted where possible.
      a. Maximum Joint Widths: 3/8 inch (9.5 mm).
      b. Damaged Corners: Cut out and replaced with an insulation piece a minimum of 12 x 12 inches (305 x 305 mm). Pieces that are cut from larger panels and are smaller than one square foot are not acceptable.
   3. Install no more than can be covered during the same working day.
   4. Taper roof insulation to drain sumps using tapered edge strips.
      a. If insulation layer is 1.5 inches (38 mm) or less, taper 12 inches (305 mm) from drain bowl.
      b. If insulation thickness exceeds 1.5 inches (38 mm), taper 18 inches (457 mm) from drain bowl.
      c. Taper boards or pieces must be adhered or mechanically fastened with a minimum of two fasteners per board.
   5. When a cover board or multiple layers are installed each layer must be offset from the previous layer a minimum of 12 inches (305 mm) on center.
   6. At the end of each working day, provide a watertight cover on all unused insulation as to avoid moisture penetration.

B. Adhered Insulation:
   1. Polyurethane:
      a. Adhesive shall be applied only to properly prepared and pre-approved substrates, free of any debris, dirt, grease, oil or moisture.
      b. The minimum product temperature at time of application shall be 70 degrees F (21 degrees C).
      c. Adhesives shall not be applied when surface or ambient temperatures are below 40 degrees F (4.4 degrees C) or above 110 degrees F (43.3 degrees C).
      d. Insulation shall be fully bonded to the substrate with a maximum board size of 48 x 48 inches (1219 x 1219 mm).
      e. Insulation shall be set into a continuous 0.5 inch (13 mm) bead of adhesive at a minimum rate of one linear foot of adhesive for every 1 sq ft (0.093 sq m) of insulation board.
      f. Adhesive rates are to be increased in roof perimeter and corner zones according to specific project requirements and manufacturer's design recommendations.
      g. Place the boards onto the adhesive beads and walk on the boards, spreading the adhesive for maximum contact.
      h. A second walking may be required after 10 minutes to ensure maximum contact and bond strength.

3.6 INSTALLATION OF MEMBRANES

A. Quality Control:

1. It is the responsibility of the Authorized Applicator to initiate and maintain a Quality Control program to govern all aspects of the installation.
2. The project foreman and or supervisor will be responsible for the daily execution of the Quality Control program which will include but is not limited to the supervision, inspection and probing of all heat welded seams incorporated within roofing system.
3. If inconsistencies in quality of the application of the composite, membrane or welds are found, work shall cease until corrective actions are taken to ensure the continuity the installation.

B. General:
1. Coordinate work ensuring that sequencing of installation promotes a 100 percent watertight installation at the end of each day.
2. When using adhesives outside ambient air temperature shall be above 40 degrees F (4.4 degrees C) and rising. Curing or drying time of the adhesive will be affected by ambient temperatures and must be taken into consideration.
3. No moisture may be present on the adhesives prior to mating or application of membranes.
4. Adhered membrane systems are to be broomed in place first and then completed by pressing the membrane into the adhesive with a weighted, foam-covered lawn roller or 50 lb (22.7 kg) linoleum roller. Lawn rollers should be filled with between 6 and 8 gallons (22.7 and 30.3 L) of water.
5. Roofing systems shall only be installed over properly prepared and sound substrates, free from excessive surface roughness, dirt, debris and moisture.

C. Adhered Membrane:
1. The Authorized Applicator shall assume full responsibility for any and all irregularities, defects or quality issues that arise due to failure to following published" installation guidelines" for the proper installation of adhered membrane roofing systems.
2. Roof Membrane (Smooth-back) Adhered with Alpha-Tite Bonding Adhesive:
    a. Position the Membrane and fold the sheet back upon itself to allow a workable exposure of the underside of the sheet.
    b. Apply a 100 percent continuous coat of bonding adhesive to the exposed bottom side of the membrane and a mirrored area of the substrate.
    c. The amount of membrane and substrate that can be coated with adhesive will be determined by application method, ambient temperature, humidity, and available manpower.
    d. Adhesive is applied by rolling, using a 3/8-in (9.5 mm) nap roller.
    e. Do not dump adhesive or pour from the cans.
    f. Apply the adhesive to ensure a smooth, even 100 percent coverage of the substrate and membrane.
    g. Roll the adhesive to ensure a smooth, even 100 percent coverage of the substrate and membrane with no voids, skips, globs, puddles or similar irregularities.
    h. Adhesive coverage should average 100 square feet per gallon of applied adhesive with a 50 sq ft per gallon (1.23 sq m per L) net coverage, plus or minus 10 percent, for the membrane and substrate combined.

i. Allow the adhesive to flash off completely and become tacky.
j. Allow a 15-20 minutes flash time (at 70º F and 50% relative humidity). Using the finger-push method, check the adhesive by applying pressure with a finger, pushing across the adhesive. The adhesive is to be tacky, but not string or be liquid.
k. When the adhesive is sufficiently cured, carefully maneuver the glued portion of the membrane onto the glued substrate surface, avoiding any wrinkles or air pockets.
l. On vertical surfaces, broom the adhered portion of the membrane to ensure full contact and complete the bonding process by firmly pressing the bonded membrane into place using a clean paint roller.
m. On horizontal surfaces, broom the adhered portion of the membrane to ensure full contact and complete the bonding process by firmly pressing the bonded membrane into place with a weighted, foam-covered, lawn roller or 50 lb. (22.7 kg.) linoleum roller.
n. Repeat the process for the remaining unbonded portion of the membrane, lapping subsequent, adjacent rolls of membrane a minimum of 3 inches (76 mm), ensuring proper shingling of the membrane to shed water along the laps.
o. No adhesive shall be applied to the lap seam areas of the membrane. Areas contaminated with adhesive are difficult to clean, will impair proper welding of the seams and require a membrane patch or strip.
p. Do not use bad or marginal adhesives. Contact FiberTite Technical Services if the quality of the adhesive is suspect.

3. Roof Membrane (Smooth-back) Adhered with FTR-190e Bonding Adhesive:
a. Position the Roof Membrane and fold the sheet to allow a workable exposure of the underside of the sheet.
b. Apply a 100 percent continuous coat of bonding adhesive to the exposed bottom side of the membrane and a mirrored area of the substrate.
c. The amount of membrane and substrate that can be coated with adhesive will be determined by application method, ambient temperature, humidity and available manpower.
d. Adhesive may be applied by spraying and back rolling or just rolling. Do not dump adhesive or pour from the cans.
e. Roller applied adhesive shall utilize a solvent resistant 3/8 inch (9.5 mm) inch nap roller, spreading the adhesive to ensure a smooth, even 100 percent coverage of the substrate and membrane.
f. Spray applied adhesive must be spread out by roller to ensure a smooth, even 100 percent coverage of the substrate and membrane with no voids, skips, globs, puddles or similar irregularities.
g. Adhesive coverage should average 100 square feet per gallon of applied adhesive with a 50 sq ft per gallon (1.23 sq m per L) net coverage, plus or minus 10 percent, for the membrane and substrate combined.
h. Allow the adhesive to dry or cure to a point of being tacky, but not stringy to the touch on both surfaces. Do not allow adhesive to completely dry out on either surface.

i. When sufficiently cured, carefully maneuver the glued portion of the membrane onto the glued substrate surface, avoiding any wrinkles or air pockets.
j. Broom the adhered portion of the membrane to ensure full contact and complete the bonding process by firmly pressing the bonded membrane into place with a weighted, foam-covered, lawn roller.
k. Repeat the process for the remaining unbonded portion of the membrane, lapping subsequent, adjacent rolls of membrane a minimum of 3 inches (76 mm), ensuring proper shingling of the membrane to shed water along the laps.
l. No adhesive shall be applied to the lap seam areas of the membrane. Areas contaminated with adhesive are difficult to clean, will impair proper welding of the seams and require a membrane patch or strip.
m. Do not use bad or marginal adhesives. Contact FTS if the quality of the adhesive is suspect.

D. Welding:
1. General:
a. Field seams exceeding 10 ft (9.3 m) in length shall be welded with an approved automatic welder.
b. Field seams must be clean and dry prior to initiating any field welding.
c. Use clean white cotton cloths and allow approximately five minutes for solvents to dissipate before initiating the automatic welder. Do not use denim or synthetic rags for cleaning.
d. Welding shall be performed only by qualified personnel to ensure the quality and continuity of the weld.
2. Hot Air Hand Welding:
a. The lap or seam area of the membrane may be intermittently tack welded to hold the membrane in place.
b. The back, interior edge of the membrane shall be welded first, with a thin, continuous weld to concentrate heat along the exterior edge of the lap during the final welding pass.
c. The nozzle of the handheld hot air welder shall be inserted into the lap at a 45-degree angle to the lap. Once the polymer on the material begins to flow, a hand roller shall be used to apply pressure at a right angle to the tip of the hand welder. Properly welded seams shall utilize a 1.5 inch (38 mm) wide nozzle, to create a homogeneous weld, a minimum of 1.5 inch (38 mm) in width.
d. Smaller nozzles may be used for corners, and other field detailing, maintaining a minimum 1 inch (25 mm) weld.
3. Automatic Hot Air Machine Welding:
a. Follow all manufacturers' instructions for the safe operation of the automatic welder.
b. Follow local code requirements for electric supply, grounding and surge protection.
c. The use of a dedicated, portable generator is highly recommended to ensure a consistent electrical supply, without fluctuations that can interfere with weld consistency.
d. Properly welded seams shall utilize a 1.5 inch (38 mm) wide nozzle, to create a homogeneous weld, a minimum of 1.5 inch (38 mm) in width.

E. Inspection:
   1. The job foreman or supervisor shall initiate daily inspections of all completed work which shall include, but is not limited to, the probing of all field welding with a dull pointed instrument to assure the quality of the application and ensure that any equipment or operator deficiencies are immediately resolved.
   2. Ensure all aspects of installation (sheet layout, attachment, welding, flashing details, etc.) are in strict accordance with the most current Manufacturer Roofing Systems Specifications and Details.
   3. Excessive patching of field seams because of inexperienced or poor workmanship will not be accepted at time of Final Inspection for Warranty Acceptance.
   4. Any deviation from pre-approved specifications or details requires written authorization from the FTS prior to application to avoid any warranty disqualification.
   5. It is the Applicator, job foreman, supervisor, or quality control personnel's responsibility to perform a final self-inspection on all seams prior to requesting the inspection for warranty issuance by the FTS.

F. T-Joint Cover Installation:
   1. Installation of T-Joint Covers is mandatory on Roof Membrane Systems nominal 50 mil (1.3 mm) or greater, vegetated roofs, ballast roofs or where T-Joints have not been properly sealed to exhibit a minimum 1.5 inch (38 mm) defined crease along the T-Joint.
   2. Install T-Joint Covers, centered and aligned so edges are parallel to roof system seams.
   3. The T-Joint Cover shall be 100 percent welded.

3.7 FLASHING

A. Clean vents, pipes, conduits, tubes, walls, and stacks to bare metal. Protrusions must be properly secured to roof deck with approved fasteners. Remove and discard lead, pipes and drain flashing. Flash penetrations according to approved details.

B. Remove loose or deteriorated cant strips and flashings.

C. Flash curbs, parapets and interior walls in strict accordance with approved roof details.

D. All flashing shall be adhered to properly prepared, approved substrates with Alpha-Tite bonding adhesive. FTR-190e bonding adhesive, applied in sufficient quantity to ensure total adhesion.

E. The base flange of all membrane flashing shall extend out on to the plane of the deck, beyond the wood nailers to a maximum width of 8 inches (203 mm).

F. Vertical flashing shall be terminated no less than 8 inches (203 mm) above the plane of the deck with approved termination bar and counter-flashing or metal cap flashing.

G. Complete all inside and outside corner flashing details with preformed corners or an approved field fabrication detail.

H. Probe all seams with a dull, pointed probe to ensure the weld has created a homogeneous bond.

I. Install penetration accessories in strict accordance with approved details. Ensure penetration accessories have not impeded in any way the working specification. Refer to the related trade for the technical specification.

3.8 METAL FLASHING

A. Ensure all fascia extend a minimum of 2 inches (51 mm) lower than the bottom of the wood nailers.

B. Fasten all metal flashing to wood nailers or approved substrate with approved fasteners 8 inches on center.

C. Solidly weld FiberClad expansion joints with a 6-inch (152 mm) strip of roof membrane welded to the Fiber Clad, covering the bond breaker tape (cover plates are optional).

D. Roof Drains:
1. Flash all roof drains in accordance with roof drain details.
2. Replace all worn or broken parts that may cut the roof membrane or prevent a watertight seal. This includes the clamping ring and strainer basket.
3. Replace all drain bolts or clamps used to hold the drain compression ring to the drain bowl.
4. Non-reinforced 60 mil (1.52 mm) membrane shall be used for flashing the drain assembly. Drain assemblies and basins or sumps must be free of any asphalt or coal tar pitch residue prior to installation.
5. The drain target sheet should be sized and installed to provide for a minimum of 12 inches (203 mm) of exposed 60 mil (1.52 mm) on all sides of the drain.

E. Pitch Pans:
1. Every reasonable effort shall be made to eliminate the need for pitch pans including the removal of existing pans. Contact FTS for specific design alternatives and recommendations.
2. In the event of no alternative, fabricate pitch pans from FiberClad metal, installed in accordance with roof details, ensuring proper attachment, maintaining a minimum of 2-inch (51 mm) clearance around the penetration.
3. Pitch Pans shall be filled with non-shrinking grout to within 1 inch (25 mm) of the top of the pan. Allow the grout to dry and fill remainder of the pan with FTR-SLS pourable sealant.
4. Pitch Pans and the sealant will require periodic maintenance by the City's maintenance personnel.

3.9 SEALANTS

A. Apply authorized sealants to all surface mounted reglets and per project requirements. Sealants are to shed water. Follow all manufacturer's instructions and installation guides.

B. Use primer when recommended by the manufacturer.

C. Sealants will require periodic maintenance by the City's maintenance personnel.

3.10 TEMPORARY SEALS

A. At the end of each working day or at the sign of rain, install temporary, 100 percent watertight seals where the completed new roofing adjoins the uncovered deck or existing roof surface.

B. The Authorized Applicator shall create and maintain the temporary seal in such a manner to prevent water from traveling beneath the new or existing roof system.

C. The use of plastic roofing cement is permissible when sealing to an existing built up roof.

D. If water is allowed to enter beneath the newly completed roofing, the affected areas shall be removed and replaced at no additional expense to the City.

E. Prior to the commencement of work, cut out and remove all contaminated membrane, insulation, roof cement or sealant and properly dispose of offsite.

3.11 WALKWAYS

A. Walkways and protection pads shall be installed at staging areas for rooftop equipment maintenance or areas subject to regular foot traffic.

B. Walkway Installation:
1. Roofing membrane to receive walkway material shall be clean and dry.
2. Cut and position the walkway material as directed by the specifications or agreement.
3. Hot air weld the entire perimeter of the walk way to the previously cleaned roofing membrane. Avoid excessive heating of the walk way material to prevent scorching the underlying roofing membrane.

3.12 LIGHTNING PROTECTION

A. The installation of lightning protection must be coordinated with the Authorized Applicator, certified lightning contractor and the City.

B. The lightning protection must be installed in such a manner that base plates, air terminals and cables do not penetrate the roofing membrane without the use of pre-approved flashing details.

C. Cables and air terminals may be attached to the membrane using base plates and FTR-101 sealant.

3.13 COMPLETION

A. Remove any and all debris, excess materials and scrap of any kind from the roof and surrounding premises prior to demobilization.

B. Inspect all field welds, detailing and terminations to ensure a 100 percent the watertight installation.

3.14 FINAL INSPECTION FOR WARRANTY

A. Upon completion of the project, the Authorized Applicator shall register the completion of the project with Manufacturer Technical Department.

B. Upon notice of completion, a Manufacturer Technical Representative will schedule an inspection with a representative of the Authorized Applicator to thoroughly review the installation and verify compliance with Manufacturer specifications.

C. Any corrections or modifications necessary for compliance with the specifications and acceptance for warranty (punch list) will be noted on the Final Inspection for Warranty Form.

3.15 SUBSTITUTIONS

Or approved equal with matching quantities, finishes, accessories & warranties.

END OF SECTION

SECTION 076200 - FLASHING AND SHEET METAL

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 work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of each type of flashing and sheet metal work is indicated on drawings and by provisions of this section.

B. Types of work specified in this section include the following:

1. Metal counter flashing

2. Metal reglet/flashing system

3. Miscellaneous sheet metal accessories.

C. Roofing accessories which are installed integral with roofing membrane are specified in roofing system sections as roofing work.

1.3 SUBMITTALS:

A. Product Data: Flashing, Sheet Metal, Accessories: Submit manufacturer's product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

B. Samples: Flashing, Sheet Metal, Accessories: Submit 8" square samples of specified sheet materials to be exposed as finished surfaces.

C. Submit 12" long, completely finished units of specified factory-fabricated products exposed as finished work.

D. Shop Drawings:

1. Engineered shop drawing to be submitted to Architect and building dept. and must meet all Florida Building Code latest edition requirements. Submit water infiltration test and wind uplift test data.

2. Flashing, Sheet Metal, Accessories: Submit shop drawings showing layout, joining, profiles, and anchorages of fabricated work, including major counter-flashings, trim/fascia units, gutters, downspouts, scuppers and expansion joint systems; layouts at 1/4" scale, details at 3" scale and wind uplift calculations.

1.4 JOB CONDITIONS:

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

A. Sheet Metal Flashing/Trim: Aluminum, ASTM B 209, alloy 3003, temper H14, mill finish; 0.032" thick.

B. Aluminum Cleats: ASTM B 209, alloy 3003, temper H14, mill finish; 0.040" thick.

C. Extruded Aluminum: Manufacturer's standard extrusions of sizes and profiles indicated, 60063-T52, mill finish; 0.080" minimum thickness for primary legs of extrusions.

D. Fasteners: Stainless Steel.

E. Bituminous Coating: FS TT-C-494 or SSPC - Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

F. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.

G. Epoxy Seam Sealer: 2-part non-corrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.

H. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.

I. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

2.2 FABRICATED UNITS:

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1" deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separation: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with mastic sealant or other permanent separation as recommended by manufacturer/fabricator.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS:

A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual". Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners and set units true to line and level as indicated. Install work with laps, joints and seams which will be permanently water-tight and weatherproof.

B. Coat substrates of concrete, wood or cement plaster with mastic sealant to effect separation between aluminum and substrate.

C. Bed flanges of work in a thick coat of bituminous roofing cement were required for waterproof performance.

3.2 CLEANING AND PROTECTION:

A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.

B. Protection: Installer shall advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction, to ensure that work will be without damage or deterioration, other than natural weathering at time of substantial completion.

END OF SECTION

SECTION 077100 -ROOF SPECIALTIES PENETRATION AND FLASHING

PART 1 - GENERAL (NOT USED)

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Metal: Stainless steel, 26 GA, type 304, 2B, ASTM A-240

B. Solder: ASTM B32, 50% tin - 50% lead; If lead-free solder is required, tin-silver, ASTM 96.5TS.

C. Foam Tape: Closed cell foam, PSA on one side, 1/4" or 3/8" x 1" wide, ASTMD-1056

D. Backer Rod: Open cell foam, 7/8", ASTM 1564

E. Sealant: Single part urethane, ASTM C920-79

2.2 FABRICATION:

A. Pitch Pans are not to be used in lieu of any other penetration flashing in these specifications and will require special approval by Design Team to be used for unusual conditions.

1. If required, fabricate stainless steel, using 7-1/2-inch stock x girth required, forming a hemmed 3-inch-high side and a 4-inch flashing flange. Provide 2-inch clearance from protrusion. If pitch pan can be slipped over penetration, shop solder four corners 4-1/2 inches with radial corners in place. If pitch pan cannot be slipped over penetration, wrap pitch pan around penetration, and solder corners and vertical seam.

B. Fabrication of flashings for pipes, conduits and other round items penetrating, resting on or anchored to roof, which allows a tubular flashing to be slipped over.

1. Form tubular flashing sleeve no less than 9 inches high and of proper diameter to provide 1/8 inch minimum - 1/4-inch maximum clearance from pipe or conduit.

2. Fabricate square flashing plate to a size 7-1/2 inch larger than protrusion. Punch hole of appropriate size in center and extrude surrounding material upward 1/4 inch, providing a continuous vertical soldering flange and solder 9-inch-high tubular flashing sleeve. Cut 1" minimum radius on flashing plate corners.

3. Fabricate counter flashing 5 inches high with a diameter 1/2 inch larger than pipe or conduit.

4. Provide a conical sealant cover, sloped outward and downward at 30 degrees to 45 degrees from the horizontal plane with an inside diameter equal to pipe or conduit size and an outside diameter 1 to 2 inches larger.

5. Shop solder all seams watertight.

6. Provide Model P/S or C/S as manufactured by SBC Industries, North Miami, FL, 800-228-2580. Include standard accessory sealant cover.

C. Fabrication of flashings for connected pipes, conduits and the round items not allowing a tubular flashing to be slipped over.

1. Form semi-cylindrical tubular flashing sleeves (180 degree) not less than 9 inches high, tightly seam intersecting halves to mate snugly. Provide a split flashing plate with radial corners and being formed upward to provide a continuous soldering flange for semi-cylindrical sleeve engagement. Size each unit to allow for vibration and thermal movement of pipe or conduit with 1/8-inch minimum x 1/4 inch maximum.

2. Form cylindrical counter flashing 5 inches high with seamed edge to a diameter 1/4 inch larger than 9-inch-high sleeve.

3. Provide conical sealant cover, sloped outward and downward at 30 degrees to 45 degrees from a horizontal plane, with an inside diameter equal to pipe or conduit size and an outside diameter 2 inches larger.

4. Provide Model P/D or C/D as manufactured by SBC Industries, North Miami, FL. Include standard accessory sealant cover.

D. Fabrication of flashings for angle irons, "H" beams, channels and square tubing.

1. Form a 6-inch-high two-piece angular configuration similar to penetration but allowing 3/16 inch minimum to 3/8-inch maximum clearance in any direction. Fabricate flashing flanges in two pieces and shop solder to 6-inch angular stacks. Provide an umbrella type counter flashing conforming to protrusion. Extend 3/4 inch at 45 degree outward from angular stack flashing.

2. Provide Model A/D, H/D, CH/D or SQ/D, as manufactured by SBC Industries, North Miami, FL. Include standard accessory sealant cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of flashing for pipes, conduits and other round items penetrating, resting on, or anchored to roofing.

1. Slide flashing unit over penetration and firmly embed flashing plate in full bed of mastic.

2. Counter flashing and sealant cover: Using a solvent with a rapid evaporation rate and leaving no residue, clean area of pipe directly above flashing. Wrap a single layer of 1/4 " to 3/8" x 1-inch wide closed cell tape around pipe, 1/4 inch above top of base sleeve. Wrap cap flashing around allowing top to extend 1/4 inch above top of tape. Apply sealant into channel at top and tool for positive runoff. Apply conical sealant cover directly above sealant.

B. Installation of flashing for connected pipes, conduits and other round items penetrating roofing or resting on roof not allowing a tubular flashing to be slipped over.

1. Base sleeves: Mate shop fabricated half sections together around pipe and solder vertical and horizontal seams watertight. Embed flashing flange in full bed of mastic.

2. Counter flashing and conical sealant cover: Using a solvent with a rapid evaporation rate and leaving no residue, clean area of pipe directly above flashing. Wrap a single layer of 1/4" to 3/8" x 1-inch wide closed cell foam tape around pipe 1/4 inch above top of base sleeve. Install cap flashing. Solder vertical seam. Apply sealant into channel and tool for positive runoff. Apply conical sealant cover directly above sealant.

C. Installation of flashing for angle, H-beams, channels and square tubing.

1. Around the protrusion snap or slide nesting flashing sections together, solder all seams and neutralize flux. At area of clearance between protrusion and top of stack flashing, insert backer rod of appropriate size 3/8 inch below top of stack flashing. Apply a liberal amount of sealant and tool for positive drainage. Install sealant cover directly above stack flashing in wet sealant.

2. Note: Prime and strip flash flange to roof per membrane manufacturer's specifications.

END OF SECTION

SECTION 78100 – APPLIED FIREPROOFING

PART 1 GENERAL

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.

2. SUMMARY

a. Section includes sprayed fire-resistive materials (SFRM).

b. Exposed intumescent mastic fire-resistive coatings.

3. PREINSTALLATION MEETINGS

a. Preinstallation Conference: Conduct conference at Project site.

1 Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

4. 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 fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4 Treatment of fireproofing after application.

c. Samples: For each exposed product and for each color and texture specified, 4 inches (102 mm) square in size.

5. INFORMATIONAL SUBMITTALS

a. Qualification Data: For Installer and testing agency.

b. Product Certificates: For each type of fireproofing.

c. Evaluation Reports: For fireproofing, from ICC-ES.

d. Preconstruction Test Reports: For fireproofing.

e. Field quality-control reports.

6. QUALITY ASSURANCE

a. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

b. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects.

1 Build mockup of each type of fireproofing and different substrate 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.

7. FIELD CONDITIONS

a. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 40 deg F (4.4 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

b. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 PRODUCTS

1. MATERIALS, GENERAL

a. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

b. Source Limitations: Obtain fireproofing from single source.

c. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1 Steel members are to be considered unrestrained unless specifically noted otherwise.

d. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction.

1 Flat Paints and Coatings: 50 g/L.
2 Nonflat Paints and Coatings: 150 g/L.
3 Primers, Sealers, and Undercoaters: 200 g/L.
4 Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.

e. Low-Emitting Materials: Fireproofing used within the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

f. Asbestos: Provide products containing no detectable asbestos.

g. Dry mix sprayed fire resistive materials containing mineral fibers are not allowed.

2. SPRAYED FIRE-RESISTIVE MATERIALS

a. Standard Durability SFRM Interior Locations, Concealed Conditions: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.

1 Products: Subject to compliance with requirements, provide the following or an approved equal:
a Grace Construction Products; W.R. Grace & Co. -- Conn; Grace Construction Products; Monokote MK-6 Series
2 Bond Strength: Minimum 200-lbf/sq. ft. (9.58-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
3 Density: Not less than 15 lb/cu. ft. (240 kg/cu. m) and as specified in the approved fire-resistance design, according to ASTM E 605.
4 Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
5 Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a Flame-Spread Index: 0.
b Smoke-Developed Index: 0.

6 Compressive Strength: Minimum 10 lbf/sq. in. (68.9 kPa) according to ASTM E 761.

7 Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
8 Deflection: No cracking, spalling, or delamination according to ASTM E 759.
9 Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
10 Air Erosion: Maximum weight loss of 0.0 g/sq. ft. (0. 0 g/sq. m) in 24 hours according to ASTM E 859.
11 Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.
12 Finish: Spray-textured finish.

b. Intermediate Durability SFRM Interior Locations, Exposed to View Only or for Buildings Between 75 and 420 Feet Tall: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.

1 Products: Subject to compliance with requirements, provide the following or an approved equal:
a Grace Construction Products; W.R. Grace & Co. -- Conn; Grace Construction Products; Monokote MK-10HB or Monokote Z-106G

2 Bond Strength: Minimum 600-lbf/sq. ft. (28.4-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
3 Density: Not less than 15 lb/cu. ft. (240 kg/cu. m) and as specified in the approved fire-resistance design, according to ASTM E 605.
4 Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
5 Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a Flame-Spread Index: 0.
b Smoke-Developed Index: 0.

6 Compressive Strength: Minimum 30 lbf/sq. in. (206 kPa) according to ASTM E 761.
7 Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
8 Deflection: No cracking, spalling, or delamination according to ASTM E 759.

9 Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
10 Air Erosion: Maximum weight loss of 0.0 g/sq. ft. (0. 0 g/sq. m) in 24 hours according to ASTM E 859.
11 Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.
12 Finish: Spray-textured finish

c. High Durability SFRM Interior or Exterior Locations, Exposed Conditions Subject to Impact: Manufacturer's standard, factory-mixed, Portland cement based dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.

1 Products: Subject to compliance with requirements, provide the following or an approved equal:

a Grace Construction Products; W.R. Grace & Co. -- Conn; Grace Construction Products**;** Monokote Z-146, Grace Construction Products; Monokote Z-156

2 Bond Strength: Minimum 10,000-lbf/sq. ft. (478-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.

3 Density: Not less than 40 lb/cu. ft. (640 kg/cu. m) and as specified in the approved fire-resistance design, according to ASTM E 605.

4 Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).

5 Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a Flame-Spread Index: 0.
b Smoke-Developed Index: 0.

6 Compressive Strength: Minimum 500 lbf/sq. in. (3450 kPa) according to ASTM E 761.

7 Corrosion Resistance: No evidence of corrosion according to ASTM E 937.

8 Deflection: No cracking, spalling, or delamination according to ASTM E 759.

9 Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.

10 Air Erosion: Maximum weight loss of 0.0 g/sq. ft. (0. 0 g/sq. m) in 24 hours according to ASTM E 859.

11 Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21

12 Finish: Spray-textured finish.

3. EXPOSED INTUMESCENT MASTIC FIRE-RESISTIVE COATINGS

a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1 Fire-Resistive, Non-Water-Based, Intumescent Mastic Coating Material:

a Albi Manufacturing, Division of StanChem Inc.; Albi Clad 800.
b Carboline Company, Fireproofing Products Div.; Nullifire S605 and topcoat provided by manufacturer of basecoat.
c Isolatek International Corp.; Cafco SprayFilm-SF II Basecoat and topcoat recommended by manufacturer of basecoat.

4. AUXILIARY MATERIALS

a. General: Provide auxiliary materials that are compatible with fireproofing 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: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:

1 Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

2 Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.

c. Bonding Agent: Product approved by fireproofing 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 fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

e. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

f. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

PART 3 EXECUTION

1. EXAMINATION

a. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

1 Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign

substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.

2 Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

3 Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

b. Verify that concrete work on steel deck has been completed before beginning fireproofing work.

c. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work.

d. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

e. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

f. Proceed with installation only after unsatisfactory conditions have been corrected.

2. PREPARATION

a. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

b. Clean substrates of substances that could impair bond of fireproofing.

c. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

d. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3. 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, has been completed.
2 Do not apply fireproofing to underside of metal roof deck until roofing has been 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 recommendations 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. Following 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. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

j. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

k. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

l. Cure fireproofing according to fireproofing manufacturer's written recommendations.

m. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

n. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1 Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
2 Spray-Textured Finish: Finish left as spray applied. Paint areas noted on plans

4. APPLICATION, EXPOSED INTUMESCENT MASTIC FIRE-RESISTIVE COATINGS

a. Apply exposed intumescent mastic fire-resistive coatings in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.

b. Apply intumescent mastic fire-resistive coating as follows:

1 Install reinforcing fabric as required to obtain designated fire-resistance rating.
2 Finish: Spray-textured finish with no further treatment.

5. FIELD QUALITY CONTROL

a. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1 Test and inspect as required by Chapter 17 of the applicable IBC.

b. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

c. Fireproofing will be considered defective if it does not pass tests and inspections.

1 Remove and replace fireproofing that does not pass tests and inspections, and retest.
2 Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

d. Prepare test and inspection reports.

6. CLEANING, PROTECTING, AND REPAIRING

a. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

b. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

c. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

d. Repair fireproofing damaged by other work before concealing it with other construction.

e. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. Work included: Furnishing and installation of firestopping material, or combination of materials, at openings and voids in, or at periphery of fire-rated construction, in locations as follows:

1. Penetrations through fire-rated floor slabs, both empty holes and holes accommodating items such as cables, pipes, ducts, conduits, etc.

2. Penetrations through fire-rated walls and partitions.

3. Openings between tops of walls and floor or roof slabs.

4. Penetrations of vertical service shafts.

5. Expansion joints in walls, floors, and wall and floor assemblies.

6. Openings and/or penetrations through smoke barriers, or special compartmentalized areas.

1.2 QUALITY ASSURANCE:

A. General: Provide firestopping materials that expand to fill cavities or provide adhesion to substrates, and that will maintain seal under normal expected movements of substrate.

B. U.L. Classification: Provide firestopping materials that are currently classified with U.L. as "Fill, Void, or Cavity Materials" and Through-Penetration Firestop Systems".

C. Fire Tests: Provide firestopping materials that have been tested in accordance with ASTM E814 "Methods for Fire tests of Through-Penetration Firestops".

1.3 SUBMITTALS

A. Submit manufacturer's product data for all materials and prefabricated devices; provide description sufficient for identification at the job site. Include manufacturer's installation instructions.

B. Submit shop drawings showing proposed material, reinforcement, anchorage, fastenings, and method of installation. Construction details shall accurately reflect actual job conditions.

1.4 CODE

A. Comply with the requirements of the latest Florida Building Code (2020).

PART 2 -- PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Firestopping materials shall be products as produced by the following manufacturers, or equal:

1. Dow Corning Corporation, Midland, Michigan 48686.

2. Electrical Products Division / 3M, St. Paul, Minnesota 55144

2.2 MATERIALS

A. Firestopping materials / constructions shall constitute one or more of the following products or an approved equal and shall be compatible with the material to which it is applied.

1. Dow Corning:

a. Fire Stop Foam (2-part silicone elastomer).

b. Fire Stop Sealant (1-part silicone elastomer).

2. 3M

a. CP-25 Caulk.

b. 303 Putty.

c. FS-195 Wrap / Strip.

d. CS-195 Composite Strip.

e. 7900 Series Penetration Sealing Systems.

3. Damming Materials: Products compatible with the above materials as certified by the manufacturer.

B. Firestopping materials shall be asbestos-free and capable of maintaining an effective barrier against flame, smoke, and gasses in compliance with the requirements of ASTM E814 and UL 1479.

C. On insulated pipe, the fire-rating classification must not require removal of the insulation.

D. The rating of the firestops shall be in no case less than the rating of the time-rated floor or wall assembly.

2.3 MIXING

A. Mix silicon components in accordance with manufacturer's instructions.

PART 3 -- EXECUTION

3.1 PREPARATION

A. Clean surfaces to in be in contact with firestopping materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting or the required fire resistance.

B. Exposed seals: Use masking tape to protect adjacent finished substrate.

3.2 INSTALLATION

A. Install firestopping materials in accordance with manufacturer's instructions.

B. Seal all holes or voids made by penetrations to ensure an effective smoke barrier.

C. Unless protected from possible loading or traffic, install firestopping materials in floors having void openings of four (4) inches or more to support the same floor load requirements.

3.3 FIELD QUALITY CONTROL

A. Examine fire stopped areas to ensure proper installation prior to concealing or enclosing fire stopped areas.

B. Areas of work shall remain accessible until inspection and approval by the applicable code authorities.

3.4 ADJUSTING AND CLEANING

A. Clean excess cured sealant, spills, etc. Remove debris.

END OF SECTION

SECTION 079000 - JOINT SEALERS

PART 1 GENERAL

1. RELATED DOCUMENTS:

a. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

2. SUMMARY

a. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
   1 Exterior joints in the following vertical surfaces and horizontal non-traffic surfaces:
      a Construction joints in cast-in-place concrete.
      b Joints between plant-precast architectural concrete units.
      c Control and expansion joints in unit masonry.
      d Joints between different materials listed above.
      e Perimeter joints between materials listed above and frames of doors, windows, and louvers.
      f Control and expansion joints in ceilings and other overhead surfaces.

   2 Exterior joints in the following horizontal traffic surfaces:
      a Isolation and contraction joints in cast-in-place concrete slabs.
      b Joints between plant-precast architectural concrete paving units.
      c Tile control and expansion joints.
      d Joints between different materials listed above.

   3 Interior joints in the following vertical surfaces and horizontal non-traffic surfaces:
      a Control and expansion joints on exposed interior surfaces of exterior walls.
      b Perimeter joints of exterior openings where indicated.
      c Tile control and expansion joints.
      d Vertical joints on exposed surfaces of concrete walls and partitions.
      e Perimeter joints between interior wall surfaces and frames of doors, windows, louvers, and elevator entrances.
      f Joints between plumbing fixtures and adjoining walls, floors, and counters.

   4 Interior joints in the following horizontal traffic surfaces:
      a Isolation joints in cast-in-place concrete slabs.
      b Control and expansion joints in tile flooring.

3. Related Sections include the following:

a. Division 8 Section "Glazing" for glazing sealants.

b. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.

c. Division 9 Section "Ceramic Tile" for sealing tile joints.

d. Division 9 Section "Acoustical Tile Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

4. PERFORMANCE REQUIREMENTS

a. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

b. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates. Extent of each form and type of joint sealer is indicated on drawings.

c. Refer to Division 15 and 16 sections for joint sealers in mechanical and electrical work; not work of this section.

5. QUALITY ASSURANCE:

a. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this project and who will assign mechanics from these earlier applications to this project, of which one will serve as lead mechanic.

b. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.

c. Pre-construction Joint Sealer-Substrate Tests: Submit substrate materials representative of actual joint surfaces to be sealed to manufacturer of joint sealer products for laboratory testing of sealants for adhesion to primed and unprimed substrates and for compatibility with secondary seals, if required, as indicated below:
   1 Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealers to joint substrates under environmental conditions that will exist during actual installation.
   2 Testing will not be required when joint sealer manufacturer is able to submit joint preparation data required above which is acceptable to Design-Build Criteria Professional and is based on previous testing of current sealant products for adhesion to, and compatibility with joint substrates matching those submitted.

6. SUBMITTALS:

a. Product Data: Submit manufacturer's technical data for each joint sealer product required, including instructions for joint preparation and joint sealer application.

b. FGBC Data: Low VOC material

c. Samples for Initial Selection Purposes: Submit manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.

d. Samples for Verification Purposes: Submit samples of each type and color of joint sealer required. Install joint sealer samples in 1/2" wide joints formed between two 6" long strips of material matching the appearance of exposed surfaces adjacent to joint sealers in the work.

e. Test Reports: Submit the following test reports:

1 Preconstruction joint sealer-substrate test results including recommendations of joint sealer manufacturer for joint preparation and application of joint sealers applicable to project conditions.

2 Certified test reports for elastomeric sealants evidencing compliance with requirements specified based on comprehensive testing of current product formulations within a 24-month period preceding date of submission of test reports to Design-Build Criteria Professional. Include test results for aged performances including hardness, stain resistance, adhesion and cohesion under cyclic movement, low-temperature flexibility, modulus of elasticity at 100% strain, effects of heat aging, and effects of accelerated weathering.

3 Certified test reports for joint sealers of type indicated below evidencing compliance with specified requirements:
   a Foam-type filler-sealants
   b Gaskets
   c Pre-Compressed, Impregnated Foam Seal

f. Certificates: Submit certificates from manufacturers of joint sealers attesting that their products comply with specification requirements and are suitable for the use indicated.

7. DELIVERY, STORAGE, AND HANDLING:

a. Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.

b. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

8. PROJECT CONDITIONS:

a. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:

1 When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturers.
2 When joint substrates are wet due to rain, condensation or other causes.

b. Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than allowed by joint sealer manufacturer for application indicated.

9. WARRANTY

a. 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: Three years from date of Substantial Completion.

b. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1 Warranty Period: Ten years from date of Substantial Completion.

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

1. MATERIALS, GENERAL:

a. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with, and will adhered to, one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

b. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

c. Exterior Single-Component Urethane-Base Sealant:
1 Products:
a Dymonic 100: ASTM C 920 Type S, Grade NS, Class 50, Use NT, T, M, A, O, I (Basis of Design).

b Dymonic FC: ASTM C 920 Type S, Grade NS, Class 35, Use NT, M, A and O
c Or Approved Equal

2 Type and Grade: M (multi component) and NS (nonsag).
3 Class: 50.
4 Federal Specifications TT-S-227 compliant
5 Provide primer and building paint on all exposed joints.

d. Interior Single-Component Acoustical Sealant:
1 Acoustical Sealant for Exposed and Concealed Joint: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
2 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.
3 Products:
a Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b Tremco Corporation; Tremflex 834 Siliconized Interior Latex Sealant
c United States Gypsum Co.; SHEETROCK Acoustical Sealant.
d Or Approved Equal

e. All sealants shall be delivered to the job site in sealed containers bearing the manufacturer's name, mixed, stored, handled and applied in strict accordance with the manufacturer's detailed printed specifications, recommendations and instructions, copies of which shall be submitted with samples for approval and made available to the Design-Build Criteria Professional at all times on the job site.

f. Manufacturer's label shall indicate the date of manufacture of sealants, or manufacturer shall otherwise attest to the date of manufacture. The period of time lapsed for polysulfide shall be not longer than six (6) months, and three (3) months for polyurethane, from the date of manufacture to the date of usage on the job.

g. Primers where required shall be as recommended by the sealant manufacturer.

h. The color of the sealants shall be as selected by the Design-Build Criteria Professional from the manufacturer's standard range of colors.

i. Bond-breakers where required shall be as recommended by the sealant manufacturer in writing to the Design-Build Criteria Professional.

j. Joint filler material in back of the sealants shall be a closed cell polyethylene or closed cell neoprene conforming to the requirements specified hereinafter.

k. Traffic Joints: (Subject to Vehicular or Pedestrian Traffic) Sealant at traffic joints shall be two-part polyurethane-base sealant of self-leveling consistency, meeting the following standards:

1 Allowable shrinkage when tested according to Federal Specifications TT-S-227, sealant shall have maximum allowable weight loss of (4) percent.
2 Guarantee as herein before specified.

l. Filler material for traffic joints shall be a non-impregnated pre-compressed, impregnated foam seals, supporting type, compressible, resilient, free from tar, asphalt, oil, and other foreign substances. Filler shape shall be such that sealant in joint is fully supported against puncture or pressure, but of design to prevent sealant from being forced out of joint by contraction. Filler shall have characteristics of not bonding with sealant, or approved release material, shall be employed at surface of filler. Filler shall be at least 30% wider than width of joint measured in field to which it is applied. Compression on such installed filler shall be sufficient so as to allow no displacement.

PART 3 EXECUTION

1. INSPECTION:

a. Require Installer to inspect joints indicated to receive joint sealers for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Obtain Installer's written report listing any conditions detrimental to performance of joint sealer work. Do not allow joint sealer work to proceed until unsatisfactory conditions have been corrected.

2. PREPARATION:

a. Pre-Installation Meeting: At Design / Builder's direction, Installer, joint sealer manufacturers' representatives, and other trades whose work affects installation of joint sealers shall meet at project site to review procedures and time schedule proposed for installation of joint sealers which is coordinated with other, related work.

b. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:

1 Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer, oil, grease, waterproofing, water repellents, water, surface dirt and frost.

2 Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3 Remove laitance and form release agents from concrete.

4 Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

c. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior

experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond; do not allow spillage or migration onto adjoining surfaces.

d. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which 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. INSTALLATION OF JOINT SEALERS:

a. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

b. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

c. Solvent-Release-Curing Sealant Installation Standard: Comply with requirements of ASTM C 804 for use of solvent-release-curing sealants.

d. Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants.

e. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.

f. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1 Install joint-fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
   a Do not leave gaps between ends of joint-fillers.
   b Do not stretch, twist, puncture or tear joint-fillers.
   c Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.

2 Install bond breaker tape between sealants and joint-fillers, compression seals or back of joints where required to prevent third-side adhesion of sealant to back of joint.

3 Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.

g. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided

for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

h. Tooling of Non-Sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1 Concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.
2 Flush joint configuration per Figure 6B in ASTM C 962, where indicated.
3 Use masking tape to protect adjacent surfaces of recessed tooled joints.
4 Recessed joint configuration per Figure 6C in ASTM C 962, of recess depth and at locations indicated.

i. Installation of Pre-Formed Hollow Neoprene Gaskets: Install gaskets, with minimum number of end joints, in joint recesses with edges free of spalls and sides straight and parallel, both within tolerances specified by gasket manufacturer. Apply manufacturer's recommended adhesive to joint substrates immediately prior to installing gaskets. For straight sections provide gaskets in continuous lengths; where changes in direction occur, adhesively splice gasket together to provide watertight joint. Recess gasket below adjoining joint surfaces by 1/8" to 1/4".

j. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs.

4. PROTECTION AND CLEANING:

a. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they 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 sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

b. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

END OF SECTION

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. Architectural joint systems for building interiors.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for cast-in architectural-joint-system frames furnished, but not installed, in this Section.

2. Division 07 Section "Flashing and Sheet Metal" for sheet metal wall joint systems.

3. Division 07 Section "Joint Sealers" for liquid-applied joint sealants.

1.3 DEFINITIONS

A. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

B. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

C. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint.

D. Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

1.4 SUBMITTALS

A. 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. Placement Drawings: Include line diagrams showing plans, elevations, sections, details, splices, blockout requirement, entire route of each joint system, and attachments to other work. Where joint systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

B. Product Data: Submit copies of manufacturer's latest published literature for materials specified herein for approval and obtain approval before materials are fabricated and delivered to the site. Data to clearly indicate movement capability of cover assemblies and suitability of material used in exterior seal for UV exposure.

C. Samples for Initial Selection : For each type of joint system indicated.

1. Include manufacturer's color charts showing the standard range of colors and finishes available for each exposed metal and elastomeric seal material.

D. 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.

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. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Design Team, except with Design Team's approval. If modifications are proposed, submit comprehensive explanatory data to Design Team for review.

D. Loading Characteristics: Heavy duty covers that are capable of withstanding up to 2000 lb. point loads.

E. 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.

1.6 COORDINATION

A. Coordinate installation of exterior wall joint systems with roof expansion assemblies to ensure that wall transitions are watertight.

1.7 WARRANTY

A. Manufacturer’s Warranty: Supply manufacturer’s standard warranty for a period not less than 5 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL JOINT SYSTEMS, GENERAL

A. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

B. Design architectural joint systems for the following size and movement characteristics:

1. Nominal Joint Width: As indicated on Drawings

2. Lateral Shear Movement Capability: 100%

2.2 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING EXTERIOR

A. Manufacture: Subject to compliance with requirements, provide expansion control by one of the following (or approved equal)

1. Joint System for Roof

a. Basis of Design Product: Construction Specialties, Inc. model SRJ series

b. Load Capacity: Heavy Duty

c. Fire Resistance Rating: Provide joint system assembly with a rating not less than that of adjacent construction.

2. Joint System for Exterior Wall

a. Basis of Design Product: Construction Specialties, Inc. model SC series

b. Load Capacity: Heavy Duty

c. Fire Resistance Rating: Provide joint system assembly with a rating not less than that of adjacent construction.

2.3 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING INTERIORS

A. Manufacture: Subject to compliance with requirements, provide expansion control by one of the following (or approved equal)

1. Joint System for Floor to Floor and Wall to Wall

a. Basis of Design Product: Construction Specialties, Inc. model GFS-100

b. Type: Surface Mounted

c. Type; Elastomeric seal

1) Exposed Metal; Aluminum

a) Finish: Class II, clear anodic

2) Seal Material: Thermoplastic rubber

a) Color: As selected by General Contractor's consultant from manufacture's standard range

b) Gasket to be dual durometer and have a flat profile that is free of ridges/reveals that collect dirt.

d. Attachment Method: Mechanical anchors.

e. Load Capacity: Standard duty.

f. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.

g. Moisture Barrier: Manufacturer's standard.

2. Joint System for Floor to Wall

a. Basis of Design Product: Construction Specialties, Inc. model GFSW-100

b. Type: Surface Mounted

c. Type; Elastomeric seal

1) Exposed Metal; Aluminum

a) Finish: Class II, clear anodic

2) Seal Material: Thermoplastic rubber

a) Color: As selected by General Contractor's consultant from manufacture's standard range.

b) Gasket to be dual durometer and have a flat profile that is free of ridges/reveals that collect dirt.

d. Attachment Method: Mechanical anchors.

e. Load Capacity: Standard duty.

f. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.

g. Moisture Barrier: Manufacturer's standard.

3. Joint System for Ceiling to Ceiling

a. Basis of Design Product: Construction Specialties, Inc. model FCF-100

b. Type: Flat seal

1) Exposed Metal: Aluminum

a) Finish: Mill

2) Seal Material: Satoprene.

a) Color: As selected by General Contractor's consultant from manufacture's standard range

2.4 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6005A-T61, 6063-T5, 6061-T5, 6105-T5 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.

2. Mill Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

3. 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.

4. 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.

5. 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.

B. Stainless Steel: ASTM A 666, Type 304 for plates, sheet, and strips.

1. Finish: No.4, directional satin.

a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

b. polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Compression Seals: ASTM D2000; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.

E. 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 rating period.

F. Moisture Barrier: 7-ply laminate reinforced Polyethylene.

G. 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

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and blockouts where architectural joint 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 architectural joint system manufacturer's written instructions.

B. Repair concrete slabs and blockouts using manufacturer's recommended repair grout of compressive strength adequate for anticipated structural loadings.

C. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

D. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.

1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Design Team 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. Heavy-Duty Systems: Repair or grout blockout as required for continuous frame support and to bring frame to proper level. Shimming is not allowed.

6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

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. Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.

F. Fire-Resistance-Rated Assemblies: Coordinate installation of architectural joint assembly 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.

G. 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 joints. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Standard steel doors hollow metal doors and frames is indicated on door schedules on drawings.

B. Related Sections include the following:

1. Division 8 Section "Door Hardware".

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.3 QUALITY ASSURANCE:

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.

B. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E 152 "Standard Methods of Fire Tests of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

C. Shop Primer: ASTM - B117; Fed. Spec. TT-F-636.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements.

B. Product Approval: Submit Miami Dade product approval data

C. Sustainability Submittals: Florida Green Building Coalition (FGBC) min. Silver rating

D. Shop Drawings: Submit for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

E. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

F. Coordinate with manufacturer and installer of electronic access control devices and supply shop drawings illustrating complete installation.

G. Indicate coordination of glazing frames and stops with glass and glazing requirements.

H. Indicate coordination of reinforcement with hardware schedule.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.

B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

1.6 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design exterior doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and Construction Documents indicated.

B. Structural Performance, Exterior Doors: Exterior doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to ASCE 7-10. Comply with the requirements of the latest Florida Building Code (2020) and subsequent revisions “High Velocity Hurricane Zone”.

1. Building Design Parameters:

a. Basic Wind Speed: 210 MPH. (See structural documents)

b. Ground Exposure: C

c. Building Category: IV

d. Enclosed Building

2. Design Pressures for Exterior Doors:

a. See structural documents for design pressures.

3. Testing Criteria:

a. ANSI/DASMA-108

b. ASTM E 330

c. Provide exterior door systems tested according to

1) TAS- 100A – Wind Driven Rain

2) TAS- 201 – Large and Small missile Impact

3) TAS-202 – Air Leakage, Water Penetration, & Structural Performance

4) TAS-203 - Cycling

d. Current Florida Building Code (FBC) (2020) - HVHZ

4. Deflection Limits: Design exterior doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

C. Operability under Wind Load: Design exterior doors to remain operable under design wind load, acting inward and outward.

D. Windborne-Debris-Impact-Resistance Performance: Provide impact-resistant exterior doors that pass large missile-impact and cyclic-pressure tests when tested according to latest Florida Building Code (2020)

1. Large Missile Test: For exterior doors located within 60 feet of grade.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of Steel door assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.

b. Faulty operation.

c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.

2. Warranty Period for Steel Doors: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide steel doors and frames by one of the following:

1. Exterior Doors:

a. Steel Doors and Frames:

1) Steelcraft/Div. Ingersoll Rand –

a) Single Door: Miami Dade NOA 17-0426.02

b) Double Door: Miami Dade NOA 17-0426.04

c) Single Door with mortise hardware: Miami Dade NOA 17-1026.24

2) Substitutions allowed.

2. Interior Doors:

a. Any available manufacturer with tested door assemblies meeting specifications herein.

2.2 MATERIALS:

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.

B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

C. Supports and Anchors: Fabricate of not less than 18-gage galvanized sheet steel.

D. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

E. Shop Applied Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.3 FABRICATION GENERAL: (All gages noted are U.S. Standard)

A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Comply with SDI-100 requirements.

B. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gage inverted steel channels.

C. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot- rolled steel (at fabricator's option).

D. Fabricate all doors, panels and frames from galvanized sheet steel.

E. Exposed Fastener: Not permitted.

F. Sound-Rated (Acoustical) Assemblies:

1. Provide acoustical assemblies with sound ratings of STC 49 to 53 or better in accordance with section 08346.

G. Finish Hardware Preparation: Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.

H. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.

I. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.

J. Shop Painting:

1. Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.

2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

3. Apply shop coat of baked on, rust inhibitive primer to provide a uniformly finished surface ready to receive finish paint.

2.4 STANDARD STEEL DOORS:

A. Provide metal doors of types and styles indicated on drawings or schedules.

1. Interior Doors: SDI-100, Grade III, extra heavy-duty, Model 2, minimum 0.0598-inch-thick (16-gage) faces.

2. Exterior Doors: SDI-100, Grade IV, maximum-duty, Model 2, minimum 0.0747-inch-thick (14-gage) faces.

B. Internal Stiffeners: 18 gage cold rolled steel.

C. Sound Deadening: Type standard with the manufacturer. Minimum 4 lb. density.

D. Hardware Reinforcement: Steel

1. Hinges: 7 gage x 1-1/2 inches x 10 inches

2. Closers and Holders: 12 gage x 5 inches x 12 inches

3. Locks: 7 gage x 1-1/4 inches x 3 inches

4. Push-Pull Plates: 16 gage x 14 inches x 14 inches

5. Panic Bars: 3 inches x 8 inches and 4 inches x 24 inches. 12 gage

6. Glazing and Louver Beads: 18 gage

2.5 STANDARD STEEL FRAMES:

A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated.

1. Fabricate frames with mitered and welded corners.

2. Frames shall be 0.0747-inch-thick (14 gage)

B. Door Silencers: Except on weather-stripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.

C. Plaster Guards: Provide 26-gage steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

D. Removable Mullion: Provide removable mullion for all exterior double doors and all interior double doors accessible to the public.

E. Grout: Fully grout all frames installed in concrete or masonry walls.

F. Hardware Reinforcement:

1. Hinges: 7 gage x 1-1/2 inch x 10 inches

2. Closers and Holders: 12 gage x 16 inches

3. Strikes: 12 gage x 1-1/4 inch x 3 inches or 14 gage drawn box.

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. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

B. Placing Frames: Comply with provisions of ANSI/SDI-A250.11-2012 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.

C. Except for frames located at in-place concrete or masonry and at drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.

D. In masonry construction, locate 4 wall anchors per jamb at hinge and strike levels.

E. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices. Frames shall be fully grouted prior to installation.

F. Install fire-rated frames in accordance with NFPA Std. No. 80.

G. In metal stud partitions, install at least 4 wall anchors per jamb at hinge and strike levels. In open steel stud partitions, place studs in wall anchor notches and wire tie. In closed steel stud partitions, attach wall anchors to studs with tapping screws.

H. Door Installation:

1. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.

2. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

3.3 ADJUST AND CLEAN:

A. Prime coat touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from pre-finished doors.

C. Final Adjustments: Check and re-adjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION

SECTION 083100 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Access door and frame units, fire-rated and non-fire-rated, in wall, and ceiling locations.

1.2 RELATED REQUIREMENTS

A. Section 09 91 13 – Exterior Painting

B. Section 09 91 23 – Interior Painting

C. Division 23 - Mechanical Work.

D. Division 26 - Electrical Work.

1.3 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

B. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.4 DESIGN REQUIREMENTS

A. Fabricate floor access assemblies to support live load of 100 lb/sq ft with deflection not to exceed 1/180 of span.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work. Include fire rating for fire rated access panels.

C. Shop Drawings: Indicate exact position of all access door units.

D. Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

E. Samples: Submit two access units, 24x24 inch in size illustrating frame configuration.

F. Manufacturer's Installation Instructions: Indicate installation requirements.

G. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

H. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated access doors.
   1. Provide access doors of fire rating equivalent to the fire rated assembly in which they are to be installed.

B. Source Limitations: Obtain each type of access doors and frames through one source from a single manufacturer.

C. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors and frames.
2. ASTM E 119 or UL 263 for horizontal access doors and frames.

1.7 PROJECT CONDITIONS

A. Coordinate the work with other work requiring access doors.

1.8 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Access Doors:
   1. Acudor Products Inc: www.acudor.com.
   2. Karp Associates, Inc: www.karpinc.com.
   3. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
   4. Substitutions: See Section 01 61 00 – Basic Product Requirements

2.2 ACCESS DOORS AND PANELS

A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies' units are to be installed in.

B. Units in Fire Rated Assemblies: Fire rating equivalent to the fire rated assembly in which they are to be installed.

2.3 ACCESS DOOR UNITS - WALLS AND CEILINGS

A. Door and Frame Units: Formed steel.
   1. Frames and flanges: 0.058-inch steel.
   2. Door panels: 0.070-inch double sheet with integral non-combustible insulation filler.
   3. Size: As indicated.
   4. Hardware:
      a. Hinge: 175-degree stainless steel piano hinge with removable pin.
      b. Lock: Cylinder lock with latch, two keys for each unit.
   5. Galvanized, hot dipped finish.
   6. Prime coat with alkyd primer.
   7. Finish: Two coats baked enamel; color as selected.

B. Non-Fire Rated Door and Frame Units in Walls:
   1. In Masonry:
      a. Model MC manufactured by Karp Associates, Inc.
   2. In Gypsum Board on Steel Studs:
      a. Model MC manufactured by Karp Associates, Inc.

C. Non-Fire Rated Flush Access Door and Frame Units in Walls and Ceilings:

1. In Gypsum Board on Metal Studs:
   a. Model KDW manufactured by Karp Associates, Inc.
2. In Plaster on Metal Furring:
   a. Model DSC-214PL manufactured by Karp Associates, Inc.

D. Fire Rated Door and Frame Units in Walls:
1. In Masonry:
   a. Model KRP-250 FR manufactured by Karp Associates, Inc.
2. In Gypsum Board on Steel Studs:
   a. Model KRP-250 FR manufactured by Karp Associates, Inc.

E. Non-Fire Rated Door and Frame Units in Ceilings:
1. In Gypsum Board on Metal Furring:
   a. Model KSTDW manufactured by Karp Associates, Inc.
2. In Metal T-Bar Suspension Ceiling:
   a. Model KSTE manufactured by Karp Associates, Inc.

F. Fire Rated Door and Frame Units in Ceilings:
1. In Gypsum Board on Metal Furring:
   a. 1 1/2-hour B label fire rating.
   b. Model KRP-150 FR manufactured by Karp Associates, Inc.

2.4 FABRICATION

A. Weld, fill, and grind joints to ensure flush and square unit.

B. Provide access door and frame assemblies manufactured as integral units ready for installation.

C. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

D. For cylinder lock, furnish two keys per lock and key all locks alike.
1. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.2 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed or otherwise damaged.

END OF SECTION

SECTION 084113 – ALUMINUM SWING DOORS - 35H

PART 1 GENERAL

Furnish all necessary materials, labor, and equipment for the complete installation of the aluminum swing doors, door frames, hardware, and storefront framing system as shown on the drawings and specified herein.

1.01 SUMMARY

A. Section includes: Aluminum Swing Doors, including:
   1. YKK AP Model 35H Impact Resistant and Blast Mitigating Heavy Duty Swing Doors.
   2. YKK AP Model 35H Impact Resistant and Blast Mitigating Heavy Duty Swing Doors for Insulating Glass.

B. Related Sections:
   1. Glass: Contact YKK AP for approved glass types.
   2. Glazing: Structural silicone sealant.
   3. Single Source Requirement: All products listed below shall be by the same manufacturer.
      a. Section 08 32 13 Sliding Aluminum-Framed Glass Doors.
      b. Section 08 44 13 Glazed Aluminum Curtain Walls.
      c. Section 08 44 33 Sloped Glazing Assemblies.
      d. Section 08 51 13 Aluminum Windows.

1.02 SYSTEM PERFORMANCE DESCRIPTION

A. All test unit sizes and configurations shall conform to the minimum sizes in accordance with; Florida High Velocity Hurricane Zone (HVHZ) Protocols, ASTM E 1886, ASTM E 1996, all requirements of TAS 201, TAS 202, and TAS 203. They shall also comply with the following specific performance requirements indicated.
   1. Air Infiltration (Single Acting Butt Hinges, Continuous Hinges, or Offset Pivots): Air infiltration shall be tested in accordance with ASTM E 283 at static pressure of 1.57 PSF (75 Pa). Infiltration shall not exceed 0.50 CFM/FT² for single door or 1.00 FM/FT² for pair doors.
   2. Water Infiltration: No uncontrolled water other than condensation on indoor face of any component tested in accordance with ASTM E 331 at a test pressure differential of 10.5 psf (503 Pa). Water test to be performed immediately after design pressure test. Standard 35H Entrances are intended for 1st floor applications.
   3. Structural: Door corner structural strength shall be tested per YKK AP's dual moment test procedure and certified by an independent testing laboratory to ensure corner integrity and weld compliance. Certified test procedures and results are available upon request.
   4. Structural Uniform Load Test:
      a. Doors:
         1) Positive Pressure:
            70 PSF – For Air Only or Air and Water Threshold; monolithic glazing.
            90 PSF – For Air Only Threshold; insulating glazing.
            70 PSF – For Air and Water Threshold; insulating glazing.
         2) Negative Pressure: 90 PSF
   5. Forced Entry Resistance: Tests performed simultaneously with 300 lb. forces applied

to the active door panel within 3" of the locks in the direction that would tend to open the door while 150 lb. forces are applied in both perpendicular directions to the 300 lb. force simultaneously.

6. Thermal Performance: When tested in accordance with AAMA 1503 and NFRC 102:
   a. Condensation Resistance Factor (CRF_f): A minimum of 28.
   b. Thermal Transmittance U Value: 0.77 BTU/HR/FT²/ºF or less.
      Note: Thermal Performance for the glazed system as a whole will be affected by the characteristics of the glass specified.
7. Acoustical Performance: Acoustical Performance: When tested in accordance with ASTM E 90, AAMA 1801:
   a. Sound Transmission Class (STC) shall not be less than: 1" IGU; 32, laminated; 34.
   b. Outdoor–Indoor Transmission Class (OITC) shall not be less than: 1" IGU; 30, 1" laminated; 31.

1.03 SUBMITTALS

A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Section. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract".
B. Product Data: Submit product data for each entrance series specified.
C. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples, and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.
D. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, and finish colors.
E. Samples: Submit verification samples for colors. Minimum 2½ inch by 3 inch (61mm by 73 mm) samples on actual aluminum substrates indicating full color range expected in installed system.
F. Quality Assurance / Control Submittals:
   1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
   2. Installer Qualification Data: Submit installer qualification data.
G. Close-out Submittals:
   1. Warranty: Submit executed warranty documents specified herein, endorsed by YKK AP authorized official and installer.
   2. Project Record Documents: Submit project record documents, including operation and maintenance data for installed materials in accordance with Division 1 Project Close-out (Project Record Documents) Section.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer experienced (as determined by contractor and Design team) to perform work of this section who has specialized in the installation of work similar to that required for this project. Requested by City, submit reference list of completed projects.
   2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.
B. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain City's and Architect's acceptance of finish color, and workmanship standard.

1. Mock-Up Size:
2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
3. Incorporation: Mock-up may be incorporated into final construction upon City's approval.

C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.05 PRODUCT CONDITIONS / SITE CONDITIONS

A. 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 toavoid construction delays.

1.06 WARRANTY

A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.
B. Manufacturer's Warranty: Submit, for City's acceptance, manufacturer's standard warranty document executed by an authorized company official.
1. Warranty Period: Manufacturer’s one (1) year standard warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment by YKK AP America Inc.
2. Provide the extended warranty periods are available for the City to consider additional cost. Provide separate line items.

PART 2 PRODUCTS

It is the intent of this specification to have a single source responsibility for the supply of the aluminum doors and framing systems on this project. Any deviation from the acceptable manufacturers listed below must be approved in writing by the architect at least thirty (30) days prior to bid date.

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)

A. Acceptable Manufacturers: YKK AP America Inc.
101 Marietta Street NW, Suite 2100
Atlanta, GA 30303
Telephone: (678) 838-6000; Fax: (678) 838-6001

B. Allowed substitution: Approved equal.
1. Impact Resistant and Blast Mitigating Entrances:
YKK AP Model 35H Impact Resistant and Blast Mitigating Entrances.
a. 35H Description: 3-7/8" (98.36 mm) Door Stile, 2-3/8" thick.
2. Corner Construction: Fabricate door corners joined by concealed reinforcement secured with screws and sigma deep penetration welding.
3. Glazing: Manufacturer's standard glazing stops with EPDM glazing gaskets to prevent water infiltration at the exterior and structural silicone sealant for wet glazing, EPDM silicone compatible gasket for dry glazing with fixed stops at the interior.
4. Weather-stripping: Manufacturer's standard elastomer type in replaceable rabbets for stiles and rails.
5a. Standard Hardware:

(1-1/2 to 2) pair of Grade 1 mortised butt hinges per leaf. Ball bearing 4-1/2" x 4" NRP Stainless Steel US32D finish.
(1) Adams Rite® MS1850 three point hookbolt lock on active leaf or single door. (1) Adams Rite two point lock on inactive leaf.
(2) H-4202 Keyed cylinders (H-4204 thumbturn on inside optional).
Type "A" standard YKK AP push/pull (Type "C" 1" diameter tubular push/pull is optional).
LCN 4040 surface mounted closer (hold open optional).
(1) Adams E9-0503 mill finish (air only) threshold.

5b. Optional Hardware:
Rixson® offset pivots.
Roton® 780-226HD continuous hinge(s).
Select® SL 27HD continuous hinge(s).
MS 1850 Single Point (Active) with Flush Bolts (Inactive)
MS 2180 Flush Bolts (Inactive) with either MS 1850 Single or 3 point
Von Duprin® Rim Panic (98 / 99 series).
Sargent® Rim Panic – WS-AD8500.
Corbin Russwin® Rim Panic ED4200.
Yale® Rim Panic 7250 M.
Falcon™ (Dor-O-Matic®) HS2390 CVR.
Falcon™ (Dor-O-Matic®) HS1690 CVR.
Falcon™ (Dor-O-Matic®) 1490 CVR.
Sargent AD 8400 CVR.

2.02 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.
B. Aluminum Sheet:
1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.
2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080" (1.95) mm) minimum thickness.

2.03 ACCESSORIES

A. Manufacturer's Standard Accessories:
1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series less steel 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.
4. Glazing Adhesive: Dow Corning® 995 Structural Silicone Sealant.

2.04 FABRICATION

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.
1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.

2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.05 FINISHES AND COLORS

A. YKK AP America Anodized Plus® Finish:

CODE	DESCRIPTION
YS1N*	Clear Anodized Plus® - USE FOR THIS PROJECT STANDARD AVAILABLE FINISH *

Other options noted below.

YH3N	Champagne Anodized Plus®
YB1N	Medium Bronze Anodized Plus®
YB5N*	Dark Bronze Anodized Plus®
YK1N*	Black Anodized Plus®
YW3N	White Anodized Plus®
M	Mill Finish

* Indicates standard finish usually carried as inventory.

Anodized Plus® is an advanced sealing technology that completely seals the anodic film yielding superior durability. (See AAMA 612).

B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:

1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612-02. Aluminum extrusions shall be produced from quality-controlled billets meeting AA-6063-T5.
   a. Exposed Surfaces shall be free of scratches and other serious blemishes.
   b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
   c. The anodized coating shall comply with all of the requirements of AAMA 612-02: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic

   Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
   d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

C. High Performance Organic Coating Finish:

1. Fluoropolymer Type: Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer-based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with YKK AP procedures and meeting AAMA 2605 specifications.
2. Colors: Selected by Architect from the following:
   a. Standard coating color charts.
   b. Custom coating color charts.
   c. Color Name and Number:

D. Finishes Testing:

1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh. Do not clean area further.
2. Submit samples with test area noted on each sample.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions. The latest installation instructions for this product are available at www.ykkap.com.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.
   1. Verify location of preset anchors, perimeter fasteners, and block-outs are in accordance with shop drawings.

3.03 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
   1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.04 INSTALLATION

A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Adjust swing doors for operation in accordance with manufacturer's recommendations.

B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to City's acceptance, and remove construction debris from project site. Legally dispose of debris.

C. Protection: The General Contractor shall protect the installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 084113.1 – ALUMINUM SWING DOORS - 50H

PART 1 GENERAL

Furnish all necessary materials, labor, and equipment for the complete installation of the aluminum swing doors, door frames, hardware, and storefront framing system as shown on the drawings and specified herein.

1.01 SUMMARY

A. Section includes: Aluminum Swing Doors, including:
   1. YKK AP Model 50H Impact Resistant and Blast Mitigating Heavy Duty Swing Doors.
   2. YKK AP Model 50H Impact Resistant and Blast Mitigating Heavy Duty Swing Doors for Insulating Glass.

B. Related Sections:
   1. Glass: Contact YKK AP for approved glass types.
   2. Glazing: Structural silicone sealant.
   3. Single Source Requirement: All products listed below shall be by the same manufacturer.
      a. Section 08 32 13 Sliding Aluminum-Framed Glass Doors.
      b. Section 08 44 13 Glazed Aluminum Curtain Walls.
      c. Section 08 44 33 Sloped Glazing Assemblies.
      d. Section 08 51 13 Aluminum Windows.

1.02 SYSTEM PERFORMANCE DESCRIPTION

A. All test unit sizes and configurations shall conform to the minimum sizes in accordance with; Florida High Velocity Hurricane Zone (HVHZ) Protocols, ASTM E 1886, ASTM E 1996, all requirements of TAS 201, TAS 202, and TAS 203. They shall also comply with the following specific performance requirements indicated.
   1. Air Infiltration (Single Acting Butt Hinges, Continuous Hinges, or Offset Pivots): Air infiltration shall be tested in accordance with ASTM E 283 at static pressure of 1.57 PSF (75 Pa). Infiltration shall not exceed 0.50 CFM/FT² for single door or 1.00 CFM/FT² for pair doors.
   2. Water Infiltration: No uncontrolled water other than condensation on indoor face of any component tested in accordance with ASTM E 331 at a test pressure differential of 10.5 psf (503 Pa). Water test to be performed immediately after design pressure test. Standard 50H Entrances are intended for 1st floor applications.
   3. Structural: Door corner structural strength shall be tested per YKK AP's dual moment test procedure and certified by an independent testing laboratory to ensure corner integrity and weld compliance. Certified test procedures and results are available upon request.
   4. Structural Uniform Load Test:
      a. Doors:
         1) Positive Pressure:
            90 PSF – For Air Only Threshold.
            70 PSF – For Air and Water Threshold.
         2) Negative Pressure: 90 PSF
   5. Forced Entry Resistance: Tests performed simultaneously with 300 lb. forces applied to the active door panel within 3" of the locks in the direction that would tend to open the door while 150 lb. forces are applied in both perpendicular directions to the 300 lb. force simultaneously.

6. Thermal Performance: When tested in accordance with AAMA 1503 and NFRC 102:
   a. Condensation Resistance Factor (CRF_f): A minimum of 28.
   b. Thermal Transmittance U Value: 0.77 BTU/HR/FT^2/^oF or less.
      Note: Thermal Performance for the glazed system as a whole will be affected by the characteristics of the glass specified.
7. Acoustical Performance: Acoustical Performance: When tested in accordance with ASTM E 90, AAMA 1801:
   a. Sound Transmission Class (STC) shall not be less than: 1" IGU; 32, laminated; 34.
   b. Outdoor–Indoor Transmission Class (OITC) shall not be less than: 1" IGU; 30, 1" laminated; 31.

1.03 SUBMITTALS

A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Section. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract".
B. Product Data: Submit product data for each entrance series specified.
C. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples, and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.
D. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, and finish colors.
E. Samples: Submit verification samples for colors. Minimum 2½ inch by 3 inch (61mm by 73 mm) samples on actual aluminum substrates indicating full color range expected in installed system.
F. Quality Assurance / Control Submittals:
   1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
   2. Installer Qualification Data: Submit installer qualification data.
G. Close-out Submittals:
   1. Warranty: Submit executed warranty documents specified herein, endorsed by YKK AP authorized official and installer.
   2. Project Record Documents: Submit project record documents, including operation and maintenance data for installed materials in accordance with Division 1 Project Close-out (Project Record Documents) Section.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by City, submit reference list of completed projects.
   2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.
B. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer installation methods. Obtain City's and Architect's acceptance of finish color, and workmanship standard.
   1. Mock-Up Size:
   2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.

3. Incorporation: Mock-up may be incorporated into final construction upon City's approval.

C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions,
manufacturer's installation instructions, and manufacturer's warranty requirements.

1.05 PRODUCT CONDITIONS / SITE CONDITIONS

A. 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.

1.06 WARRANTY

A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.

B. Manufacturer's Warranty: Submit, for City's acceptance, manufacturer's standard warranty document executed by an authorized company official.

1. Warranty Period: Manufacturer's one (1) year standard warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment by YKK AP America Inc.

EDITOR NOTE: Longer warranty periods are available at additional cost.

PART 2 PRODUCTS

It is the intent of this specification to have a single source responsibility for the supply of the aluminum doors and framing systems on this project. Any deviation from the acceptable manufacturers listed below must be approved in writing by the architect at least ten (10) days prior to bid date.

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)

A. Acceptable Manufacturers: YKK AP America Inc.
101 Marietta Street NW, Suite 2100
Atlanta, GA 30303
Telephone: (678) 838-6000; Fax: (678) 838-6001

B. Allowed substitution: Approved equal.

1. Impact Resistant and Blast Mitigating Entrances:
YKK AP Model 50H Impact Resistant and Blast Mitigating Entrances.
a. 50H Description: 5" (127 mm) Door Stile, 2-3/8" thick.
2. Corner Construction: Fabricate door corners joined by concealed reinforcement secured with screws and sigma deep penetration welding.
3. Glazing: Manufacturer's standard glazing stops with EPDM glazing gaskets to prevent water infiltration at the exterior and structural silicone sealant for wet glazing, EPDM silicone compatible gasket for dry glazing with fixed stops at the interior.
4. Weather-stripping: Manufacturer's standard elastomer type in replaceable rabbets for stiles and rails.

5a. Standard Hardware:
(1-1/2 to 2) pair of Grade 1 mortised butt hinges per leaf. Ball bearing 4-1/2" x 4" NRP Stainless Steel US32D finish.

(1) Adams Rite® MS1850 three point hookbolt lock on active leaf or single door. (1) Adams Rite two point lock on inactive leaf.
(2) H-4202 Keyed cylinders (H-4204 thumbturn on inside optional).
Type "A" standard YKK AP push/pull (Type "C" 1" diameter tubular push/pull is optional).
LCN 4040 surface mounted closer (hold open optional).
(1) Adams E9-0503 mill finish (air only) threshold.

5b. Optional Hardware:
Rixson® offset pivots.
Roton® 780-226HD continuous hinge(s).
Select® SL 27HD continuous hinge(s).
MS 1850 Single Point (Active) with Flush Bolts (Inactive)
MS 2180 Flush Bolts (Inactive) with either MS 1850 Single or 3 point
Von Duprin® Rim Panic (98 / 99 series).
Sargent® Rim Panic – WS-AD8500.
Corbin Russwin® Rim Panic ED4200.
Yale® Rim Panic 7250 M.
Falcon™ (Dor-O-Matic®) HS2390 CVR.
Falcon™ (Dor-O-Matic®) HS1690 CVR.
Falcon™ (Dor-O-Matic®) 1490 CVR.
Sargent AD 8400 CVR.

2.02 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.
B. Aluminum Sheet:
1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.
2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080" (1.95) mm) minimum thickness.

2.03 ACCESSORIES

A. Manufacturer's Standard Accessories:
1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series less steel 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.
4. Glazing Adhesive: Dow Corning® 995 Structural Silicone Sealant.

2.04 FABRICATION

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.
1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.05 FINISHES AND COLORS

A. YKK AP America Anodized Plus® Finish:

CODE DESCRIPTION

YS1N* Clear Anodized Plus® - USE FOR THIS PROJECT POMPEY PARK

Other color options noted below.

YH3N Champagne Anodized Plus®

YB1N Medium Bronze Anodized Plus®

YB5N* Dark Bronze Anodized Plus®

YK1N* Black Anodized Plus®

YW3N White Anodized Plus®

M Mill Finish

* Indicates standard finish usually carried as inventory.

Anodized Plus® is an advanced sealing technology that completely seals the anodic film yielding superior durability

(See AAMA 612).

B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:

1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612-02. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
   a. Exposed Surfaces shall be free of scratches and other serious blemishes.
   b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
   c. The anodized coating shall comply with all of the requirements of AAMA 612-02: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
   d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

C. High Performance Organic Coating Finish:

1. Fluoropolymer Type: Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with YKK AP procedures and meeting AAMA 2605 specifications.
2. Colors: Selected by Architect from the following:
   a. Standard coating color charts.
   b. Custom coating color charts.
   c. Color Name and Number:

D. Finishes Testing:

1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh. Do not clean area further.
2. Submit samples with test area noted on each sample.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions. The latest installation instructions for this product are available at www.ykkap.com.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.
   1. Verify location of preset anchors, perimeter fasteners, and block-outs are in accordance with shop drawings.

3.03 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
   1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.04 INSTALLATION

A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Adjust swing doors for operation in accordance with manufacturer's recommendations.
B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to City's acceptance, and remove construction debris from project site. Legally dispose of debris.
C. Protection: The General Contractor shall protect the installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 084313 – ALUMINUM-FRAMED ENTRANCES & STOREFRONTS

PART 1 GENERAL

Furnish all necessary materials, labor, and equipment for the complete installation of the aluminum storefront system as shown on the drawings and specified herein.

1.01 SUMMARY

A. Section includes: Aluminum Storefront Systems
   1. YKK AP Series YHS 50 FS Impact Resistant and Blast Mitigating Storefront System (Monolithic Glazing)

B. Related Sections:
   1. Sealants: Dow Corning® 995 Structural Silicone Sealant.
   2. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.
   3. Single Source Requirement: All products listed below shall be by the same manufacturer.
      a. Section 08 44 13 Glazed Aluminum Curtain Wall.
      b. Section 08 51 13 Aluminum Windows.

1.02 SYSTEM DESCRIPTION

A. All test unit sizes and configurations shall conform to the minimum sizes in accordance with; Florida High Velocity Hurricane Zone (HVHZ) Protocols, ASTM E 1886, ASTM E 1996, and/or meet all requirements of TAS 201, TAS 202, and TAS 203. They shall also comply with the following specific performance requirements indicated.
   1. Air Infiltration: Completed storefront systems shall have 0.06 CFM/FT² (1.10 m³/h·m²) maximum allowable infiltration when tested in accordance with ASTM E 283 at differential static pressure of 6.24 psf (299 Pa).
   2. Water Infiltration: No uncontrolled water when tested in accordance with ASTM E 331 at test pressure differential of: 12 PSF (575 Pa) (or when required, field tested in accordance with AAMA 503). Fastener Heads must be seated and sealed against Sill Flashing on any fasteners that penetrate through the Sill Flashing.
   3. Wind Loads: Completed storefront system shall withstand wind pressure loads normal to wall plane indicated:
      a. Exterior Walls:
         1) Positive Pressure:
         2) Negative Pressure:
   4. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AAMA Specifications for Aluminum Structures.
      a. Without Horizontals: L/175 or 3/4" (19.1mm) maximum. .
      b. With Horizontals: L/175 or L/240 + 1/4" (6.4mm) for spans greater than 13'-6" (4.1m) but less than 40'-0" (12.2m).
   5. Thermal Movement: Provide for thermal movement caused by 180 degrees F. (82.2 degrees C.) surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.

1.03 SUBMITTALS

A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."
B. Product Data: Submit product data for each type storefront series specified.
C. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.
D. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors and textures.
E. Samples: Submit verification samples for colors on actual aluminum substrates indicating full color range expected in installed system.
F. Quality Assurance / Control Submittals:
1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
2. Installer Qualification Data: Submit installer qualification data.
G. Closeout Submittals:
1. Warranty: Submit warranty documents specified herein.
2. Project Record Documents: Submit project record documents for installed materials in accordance with Division 1Project Closeout (Project Record Documents) Section.

1.04 QUALITY ASSURANCE
A. Qualifications:
1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by City, submit reference list of completed projects.
2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.

1.05 PROJECT CONDITIONS / SITE CONDITIONS
A. 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 toavoid construction delays.

1.06 WARRANTY
A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.
B. Manufacturer's Warranty: Submit, for City's acceptance, manufacturer's standard warranty document executed by an authorized company official.
1. Warranty Period: Manufacturer’s one (1) year standard warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment by YKK AP America Inc.
2. Provide the extended warranty periods are available for the City to consider additional cost. Provide separate line items.

PART 2 PRODUCTS

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)
A. Acceptable Manufacturers: YKK AP America Inc.
101 Marietta Street NW, Suite 2100

Atlanta, GA 30303
Telephone: (678) 838-6000; Fax: (678) 838-6001

1. Storefront System: YKK AP YHS 50 FS Impact Resistant and Blast Mitigating Storefront System.

B. Storefront Framing Systems:
1. Description: Center set, exterior or interior flush glazed; jambs and vertical mullions continuous; head, sill,intermediate horizontal attached by screw spline joinery. Continuous and wept sill flashing.
2. Components: Manufacturer's standard extruded aluminum mullions, entrance doors, framing, and indicated shapes, perimeter anchor fillers and steel reinforcing as required.
3. Glazing: Manufacturer's standard glazing stops with EPDM glazing gaskets to prevent water infiltration at the exterior and Dow Corning® 995 Structural Silicone Sealant with fixed stops at the interior.

C. Allowed substitution: Approved equal.

2.02 MATERIALS
A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.
B. Aluminum Sheet:
1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.
2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080" (1.95 mm) minimum thickness.

2.03 ACCESSORIES
A. Manufacturer's Standard Accessories:
1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners.
2. 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.
3. 0.050” Aluminum Sill Flashing End Dams featuring 3 point attachment.

2.04 RELATED MATERIALS (Specified In Other Sections)
A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

2.05 FABRICATION
A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform
hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.
1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.06 FINISHES AND COLORS

A. YKK AP America Anodized Plus® Finish:

CODE DESCRIPTION

YS1N* Clear Anodized Plus® - Use for this project Pompey Park

Other colors available are listed below.

YH3N	Champagne Anodized Plus®
YB1N	Medium Bronze Anodized Plus®
YB5N*	Dark Bronze Anodized Plus®
YK1N*	Black Anodized Plus®
YW3N	White Anodized Plus®
M	Mill Finish

* Indicates standard finish usually carried as inventory.

Anodized Plus® is an advanced sealing technology that completely seals the anodic film yielding superior durability (See AAMA 612).

B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:
   1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
      a. Exposed Surfaces shall be free of scratches and other serious blemishes.
      b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
      c. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications,
         Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent
         Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
      d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

C. High Performance Organic Coating Finish:
   1. Type Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with YKK AP procedures and meeting AAMA 2605 specifications.
   2. Colors: Selected by Architect from the following:
      a. Standard coating color charts.
      b. Custom coating color charts.
      c. Color Name and Number:

D. Finishes Testing:
   1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh; Do not clean area further.
   2. Submit samples with test area noted on each sample.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions. The latest installation instructions are available at www.ykkap.com.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.
   1. Verify location of preset anchors, perimeter fasteners, and block-outs are in accordance with shop drawings.

3.03 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
   1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.04 INSTALLATION

A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.
   1. Shim and brace aluminum system before anchoring to structure.
   2. Provide sill flashing at exterior storefront systems. Extend extruded flashing continuous with slice joints; set in continuous beads of sealant.
   3. Verify storefront system allows water entering system to be collected in gutters and wept to exterior. Verify metal joints are sealed in accordance with the manufacturer's instructions.
   4. Seal metal to metal storefront system joints using sealant recommended by system manufacturer.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.
B. Field Test: Conduct field test to determine watertightness of storefront system. Conduct test in accordance with AAMA 501.2.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Adjust swing doors for operation in accordance with manufacturer's recommendations.
B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to City's acceptance, and remove construction debris from project site. Legally dispose of debris.
C. Protection: The General Contractor shall protect the installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 084413 – GLAZED ALUMINUM CURTAIN WALL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Aluminum Curtain Wall Systems:
   1. YKK AP Series YHC 300 OG (Outside Glazed) Impact Resistant Aluminum Curtain Wall System.

B. Related Sections:
   1. Sealants: Dow Corning® 995 Structural Silicone Sealant.
   2. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.
   3. Single Source Requirement: All products listed below shall be by the same manufacturer.
      a. Section 08 41 13 Aluminum - Framed Entrances and Storefronts.
      b. Section 08 51 13 Aluminum Windows.

1.02 SYSTEM PERFORMANCE DESCRIPTION

A. All test unit sizes and configurations shall conform to the minimum sizes in accordance with; Florida High Velocity Hurricane Zone (HVHZ) Protocols, ASTM E 1886, ASTM E 1996, and meet all requirements of TAS 201, TAS 202, and TAS 203. They shall also comply with the following specific performance requirements indicated.
   1. Air Infiltration: Completed curtain wall systems shall have 0.06 CFM/FT² (1.10 $m^3/h \cdot m^2$) maximum allowable infiltration when tested in accordance with ASTM E 283 at differential static pressure of 6.24 PSF (299 Pa).
   2. Water Infiltration: No uncontrolled water, other than condensation, on indoor face of any component when tested in accordance with ASTM E 331 at test pressure differential of 20 PSF (958 Pa). Water test to be performed immediately after design pressure test.
   3. Wind Loads: Completed curtain wall system shall withstand wind pressure loads normal to wall plane indicated:
      a. Structural Performance:
         1) Positive Pressure: ___ psf.
         2) Negative Pressure: ___ psf.
   4. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AA Specifications for Aluminum Structures:
      a. Without Horizontals: L/175 or 3/4" (19.1mm) maximum.
      b. With Horizontals: L/175 or L/240 + 1/4" (6.4mm) for spans greater than 13'-6" (4.1m) but less than 40'-0" (12.2m).
   5. Thermal Movement: Provide for thermal movement caused by 180 degrees F. (82.2 degrees C.) surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements damaging loads on fasteners, reduction of performance, or detrimental effects.
   6. Thermal Performance: When tested in accordance with AAMA 1503.1 and NFRC 102:
      a. Condensation Resistance Factor (CRF_f): A minimum of 72.
      b. Thermal Transmittance U Value: .42 BTU/HR/FT²/ºF or less.
      Note: The CRF for the glazed system as a whole will be affected by the characteristics of the glass specified.

7. Acoustical Performance: Acoustical Performance: When tested in accordance with ASTM E 1425:
   a. Sound Transmission Class (STC) shall not be less than 37.
   b. Outdoor–Indoor Transmission Class (OITC) shall not be less than 32.

1.03 SUBMITTALS

A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."

B. Product Data: Submit product data for each type curtain wall series specified.

C. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.

D. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage ,accessories, finish colors and textures.

E. Samples: Submit verification samples for colors on actual aluminum substrates indicating full color range expected in installed system.

F. Quality Assurance / Control Submittals:
   1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
   2. Installer Qualification Data: Submit installer qualification data.

G. Closeout Submittals:
   1. Warranty: Submit warranty documents specified herein.
   2. Project Record Documents: Submit project record documents for installed materials in accordance with Division 1Project Closeout (Project Record Documents) Section.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by City, submit reference list of completed projects.
   2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.

B. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain City's and Architect's acceptance of finish color, and workmanship standard.
   1. Mock-Up Size:
   2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
   3. Incorporation: Mock-up may be incorporated into final construction upon City's approval.

C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.05 PROJECT CONDITIONS / SITE CONDITIONS

A. 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.

1.06 WARRANTY

A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.

B. Manufacturer's Warranty: Submit, for City's acceptance, manufacturer's standard warranty document executed by an authorized company official.

1. Warranty Period: Manufacturer’s one (1) year standard warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment by YKK AP America Inc.

2. Provide the extended warranty periods are available for the City to consider additional cost. Provide separate line items.

PART 2 PRODUCTS

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)

A. Acceptable Manufacturers: YKK AP America Inc.
101 Marietta Street NW, Suite 2100
Atlanta, GA 30303
Telephone: (678) 838-6000; Fax: (678) 838-6001

1. Curtain Wall System: YKK AP YHC 300 OG Curtain Wall System.

B. Curtain Wall Framing System:

1. Description: Framing System shall be thermally improved. Horizontal and vertical members shall have a nominal face dimension of 3 inches, depth as indicated on the shop drawings. Framing system shall provide a flush glazed appearance on all sides with no protruding glass stops.

2. Glazing: Manufacturer's standard silicone compatible EPDM glazing gaskets to inhibit water infiltration at the exterior and Dow Corning® 995 Structural Silicone Sealant with fixed stops at the interior; interior spacers are to be silicone.

C. Allowed substitution: Approved equal.

2.02 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.

B. Aluminum Sheet:

1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.

2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080" (1.95 mm) minimum thickness.

2.03 ACCESSORIES

A. Manufacturer's Standard Accessories:

1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel
fasteners. Joint fasteners may be concealed.

2. 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; exterior glazing silicone compatible EPDM gaskets, in accordance with ASTM C 864, designed to lock into gasket reglet, interior by means of silicone spacer and structural silicone adhesive.

4. Glazing Adhesive: Dow Corning® 995 Structural Silicone.

2.04 RELATED MATERIALS (Specified In Other Sections)

A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

2.05 FABRICATION

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.06 FINISHES AND COLORS

A. YKK AP America Anodized Plus® Finish:

CODE DESCRIPTION

YS1N* Clear Anodized Plus® - Use for this project Pompey Park

Other colors available.

YH3N	Champagne Anodized Plus®
YB1N	Medium Bronze Anodized Plus®
YB5N*	Dark Bronze Anodized Plus®
YK1N*	Black Anodized Plus®
YW3N	White Anodized Plus®
M	Mill Finish

* Indicates standard finish usually carried as inventory.

Anodized Plus® is an advanced sealing technology that completely seals the anodic film yielding superior durability (See AAMA 612).

B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:

1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
   a. Exposed Surfaces shall be free of scratches and other serious blemishes.
   b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
   c. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications,erformance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
   d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

C. High Performance Organic Coating Finish:

1. Type Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with YKK AP procedures and meeting AAMA 2605 specifications.
2. Colors: Selected by Architect from the following:

a. Standard coating color charts.
b. Custom coating color charts.
c. Color Name and Number:

D. Finishes Testing:
1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh; Do not clean area further.
2. Submit samples with test area noted on each sample.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions. The latest Installation Manual can be found at www.ykkap.com.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

3.03 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.04 INSTALLATION

A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.
1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.
2. Shim and brace aluminum system before anchoring to structure.
3. Verify curtain wall system allows water entering system to be collected in gutters and wept to exterior. Verify weep holes are open, and metal joints are sealed in accordance with manufacturers installation instructions.
4. Seal metal to metal curtain wall system joints using sealant recommended by system manufacturer.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.

B. Field Test: Conduct field test to determine watertightness of curtain wall system. Conduct test in accordance with AAMA 501.2.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Adjust swing doors for operation in accordance with manufacturer's recommendations.

B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to City's acceptance, and remove construction debris from project site. Legally dispose of debris.
C. Protection: The General Contractor shall protect the installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

All door hardware must be coordinated with City meeting City of Delray Beach's requirements.

1.1 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

a. Swinging doors.

b. Other doors to the extent indicated.

2. Cylinders for doors specified in other Sections.

3. Electrified door hardware.

4. Access Control Vendor Coordination.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division - 1 Specification sections, apply to work of this section.

1.3 DESCRIPTION OF WORK:

A. Definition: "Finish Hardware" includes items known commercially as finish hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

B. Extent of finish hardware required is indicated on drawings and in schedules.

C. Types of finish hardware required include the following:

1. Lock and latch sets

2. Electrified Hardware

3. Lock cylinders and keys

4. Hinges

5. Closers

6. Push, Pull, Kick and Armor Plates

7. Storefront Door Pull Handles

8. Extension Flush Bolts

9. Door Stops

10. Weather-stripping for exterior doors

11. Acoustical and Fire Seals for interior doors

12. Panic Exit devices

13. Thresholds

14. Door Bottoms and Door Sweeps

15. Automatic Door Bottom

16. Door Top Rain Shield

1.4 QUALITY ASSURANCE:

A. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

B. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years, and who is, or who employs an experienced architectural hardware consultant who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to City, Architect and Contractor.

C. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and local building code requirements. Provide only hardware which has been tested and listed by UL for types and sizes of doors required and complies with requirements of door and door frame labels.

D. 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".

E. Inspection: Supplier shall inspect completed installation and notify Architect that all materials furnished have been properly located and installed.

1.5 SUBMITTALS:

A. Product Data: Submit manufacturer’s technical product data for each item of hardware in accordance with Division-1 section "Submittals". Include whatever information may be necessary to show compliance with requirements and include instructions for installation and for maintenance of operating parts and finish.

B. Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.

C. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

1. Type, style, function, size and finish of each hardware item.

2. Name and manufacturer of each item.

3. Fastenings and other pertinent information.

4. Location of hardware set cross-referenced to indications on drawings both on floor plans and in door and frame schedule.

5. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.

6. Mounting locations for hardware.

7. Door and frame sizes and materials.

8. Keying information.

D. Samples: Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule.

E. Samples will be returned to the supplier. Units which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

F. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

G. Guarantee: Submit written guarantee for all materials furnished under this section covering defects in materials and workmanship for a period of one year. Period shall begin at date of final Certificate of Acceptance.

1.6 PRODUCT HANDLING:

A. Packaging of 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.

B. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

C. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

D. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which 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 Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace hardware components 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.

b. Failure of operating components.

2. Warranty Period: Five (5) years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Failures on finish include, but not limited to, checking, crazing, peeling, chalking, fading and/or loss of adhesion.

2. Warranty Period: Twenty (20) years from date of Substantial Completion.

1.8 MAINTENANCE TOOLS

A. Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for City's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

A. GENERAL:

1. Hand of Door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

2. 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 A156 series standard for each type hardware item and with ANSI A156.1 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

3. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

4. 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 surfaced of other to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.

5. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use screw fasteners.

6. Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instructions as needed for City's continued adjustment, maintenance, and removal and replacement of furnished hardware.

7. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated below. See door schedule drawing and hardware schedule.

8. Manufacturer's Product Designations: One or more manufacturers are listed for each hardware type required. Provide either the product designated, or, where more than one manufacturer is listed, the comparable product of one of the manufacturers listed which comply with requirements including those specified elsewhere in this section.

9. Provide electronic access control card readers and electronic keypads at locations shown on plan. Card readers programming and integration by City’s Preferred Security System Vendor. See section 3.2 for contact information.

2.2 LOCKS, LATCHES AND BOLTS:

A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.

1. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.

2. Provide roller type strikes where recommended by manufacturer of the latch and lock units.

B. Lock Throw: Provide 1" minimum throw of latch and dead bolt used on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

C. Flush Bolt Heads: Minimum of 1/2" diameter rods of brass, bronze or stainless steel, with minimum 12" long rod for doors up to 7'- 0" in height. Provide longer rods as necessary for doors exceeding 7'-0" in height.

D. Exit Device Dogging: Except on fire-rated doors, wherever closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to hold the push bar down and the latch bolt in the open position.

E. Rabbeted Doors: Where rabbeted door stiles are indicated, provide special rabbeted front on lock and latch units and bolts.

F. Locksets – Schlage 'L' series Mortise Locks: ANSI / BHMA A156.13 Series 1000, Grade 1

1. Location: On all metal doors except doors with electromagnetic locks, panic devices, or STC 55 rated doors.
    a. Use Schlage ND series electrified cylinder locks for STC 55 rated doors.
2. Material:
    a. Levers: zinc base
    b. Roses: stainless steel
    c. Latch face plates and strikes: stainless steel
    d. Lock chassis is steel with stainless steel cover
3. Everest 6-pin interchangeable core in full size cylinder
4. Levers: 06A Lever – 4 3/4" long handle
5. Finish: 626 – satin chromium plated
6. Mounting: 2 1/8" diameter bore for lock housing; 1" diameter for latch tube
7. Strike: S3 – 4 7/8" x 11/4" with curved lip
8. Door Thickness: 1 3/4" (except ballistic rated doors)
9. Latch Bolt: 1" throw deadlocking latch
10. Electrified Accessories:
    a. Transformer: 8W599
    b. AC to DC Converter: 8WCON
    c. Temperature Control Module: 8WTCM

2.3 LOCK CYLINDERS AND KEYING:

A. General: Supplier will meet with City to finalize keying requirements and obtain final instructions in writing.

B. Equip locks with manufacturer's special 7-pin tumbler cylinder, with construction master key feature, which permits voiding of construction keys without cylinder removal.

C. Metals: Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.

D. Comply with City's instructions for construction master keying, grand master keying and master keying at factory. Provide keying matching City's existing keying system.

E. Permanently inscribe each key with number or lock that identifies cylinder manufacturer key symbol, and notation "DO NOT DUPLICATE".

F. Key Material: Provide keys of nickel silver only.

G. Key Quantity: Furnish 15 construction master keys to Contractor. Furnish 3 individual keys for each change.

H. All locks to be delivered to job without permanent keys.

2.4 DOOR TRIM UNITS:

A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kick plates, edge trim, viewers, knockers, mail drops and similar units); either machine screws or self-tapping screw.

B. Fabricate edge trim of stainless steel, not more than 1/2" nor less than 1/16" smaller in length than door dimension.

C. Fabricate protection plates (armor, kick or mop) not more than 1-1/2" less than door width on stop side and not more than 1/2" less than door width on pull side, x the height indicated.

D. Metal Plates: Stainless steel, .050" (U.S. 18 ga.).

2.5 HINGES:

A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

B. Screws: Furnish Phillips flat-head machine screws for installation of units, except furnish Phillips flat-head wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.

C. Pivot Hinges: BHMA A156.4, Grade 1. (allowed for retail storefront doors only)

1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

D. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

1. Hinges: Manufactured by Stanley, Hager, Zero, Ives

2. Quantity: Use 1.5 pair 3 hinges for each door leaf up to and including 7'-6" in height and 0.5 pair 1 hinge for each additional 30 inches in door height; and 0.5 pair 1 hinge for each door leaf 40 inches to 48 inches in width.

3. Ensure all doors equipped with closers are furnished with ball bearing (BB) hinges.

4. Size, Type and Finish: Provide the following unless otherwise noted in the hardware set.

5. Exterior Doors: FBB199, 4-1/2 inches x 4-1/2 inches with Non-Removable (stainless steel) Pins (NRP), BHMA 630 SATW stainless steel satin finish, ANSI 5111.

6. Interior Doors: Offices, conference rooms, workrooms, storage rooms, mechanical rooms, janitors' closets, electrical rooms and other standard use doors use standard duty hinges F179 or FBB179, 4-1/2 inches x 4-1/2inches BHMA652 steel satin Chromium finish for door leaf up to and including 36 inches wide. ANSI 8112.

E. Continuous-Gear Hinges: Manufacturer's Heavy Weight with stainless-steel bearings between knuckles, fabricated to full height of door and frame.

1. Ives: Full Mortise EPT 224HD 95" US28 (Aluminum)

F. Mortise-Type Cam Hinges: Manufacturer's Heavy Weight for use with sound insulating doors utilizing acoustical seals.

1. Zero: Full Mortise Z950

G. Mortise-Type Full Swing Hinges: Manufacturer's Heavy Weight for use with doors requiring 180-degree swings.

1. Ives: Full Mortise 5BB1SCHW

H. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

1. Steel Hinges: Steel pins.

2. Non-Ferrous Hinges: Stainless steel pins.

3. Exterior Doors: Non-removable pins.

4. Out-Swing Corridor Doors: Non-removable pins.

5. Interior Doors: Non-rising pins.

6. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.

7. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height, and for leaves over 40" in width.

2.6 CLOSERS AND DOOR CONTROL DEVICES:

A. Acceptable Product: LCN 4040 XP Series

B. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door exposure to weather and anticipated frequency of use.

1. Where parallel arms are indicated for closers, provide closer unit one size larger than recommended for use with standard arms.

C. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A117.1 provisions for door opening force and delayed action closing.

1. Opening-Force Requirements:

a. Egress Exterior Doors: Not more than 15 lb ft release the latch and not more than 30 lb ft set the door in motion and not more than 15 lb ft open the door to its minimum required width.

D. Flush Floor Plates: Provide finished metal flush floor plates for floor closers except where threshold are indicated, and cover plate is specified to be an integral part of threshold. Finish floor plate to match hardware sets, unless otherwise indicated.

E. Recessed Floor Plates: Provide recessed floor plates where no thresholds are indicated and floor closers are located in an area of resilient flooring, stone flooring or terrazzo. Recess plates to receive an insert of the floor finish material, of the normal thickness as indicated. Provide extended spindle on closer as may be necessary to accommodate thick floor finish inserts.

2.7 PUSH, PULL, KICK and ARMOR PLATES

A. Acceptable Manufacturers:

1. Ives.

2. Rockwood.

3. Trimco (Basis of Design).

B. Fabricate protection plates (armor, kick or mop) not more than 1-1/2" less than door width on stop side and not more than 1/2" less than door width on pull side, x the height indicated.

C. Metal Plates: Stainless steel, .050" (U.S. 18 ga.).

D. Push Plates: Trimco 1001-9 6 inches x 16 inches, US32D Finish.

E. Pull Plates: Trimco 1139-2 6 inches x 16 inches, US32D Finish.

F. Kick Plates: Provide on push side of doors with closers, but not on closer/holder doors unless scheduled otherwise. 10 inches high, 0.050 thick, bevelled on all exposed edges and sized as follows:

1. Single Doors: 2 inches LDW (less door width).

2. Pairs of Doors: 2 inches LDW (less door width).

G. Armor Plates: 34 inches in height, 0.050 thick, beveled on all exposed edges and sized as follows:

1. Single Doors: 2 inches LDW (less door width).

2. Pairs of Doors: 2 inches LDW (less door width).

H. Finishes: Stainless steel, US 32D; BHMA 630.

I. Provide stainless steel screws.

J. Coordinate with ADA and other accessibility code requirements.

2.8 STOREFRONT DOOR PULL HANDLES:

A. First Impressions International, Inc.

1. Push and Pull Handles – Model #8412 brushed stainless steel finish 1 ½" dia x 48" long

2. (2) required per single door; (4) required at double doors.

2.9 EXTENSION FLUSH BOLTS:

A. Provide extension flush bolts as manufactured by Trimco Model 3917 UL Listed, 12 inches US 32D finish.

B. Provide Trimco Model 3915, dust proof strike 3910 with plate with screws and lead shields.

2.10 DOORSTOPS

A. Wall Door Stop: Provide Trimco Model 1270CVPV-wall stop in US 32D Finish. Wall stop shall have anti-rotation pin so rubber cannot be removed. Install backing in all walls.

B. Floor Door Stop: Provide Trimco Model 1214H-floor stop in US 32D Finish.

2.11 WEATHER-STRIPS AND SWEEPS

A. General: Except as otherwise indicated, provide continuous weather-stripping at each edge of every exterior door leaf. Provide type, sizes and profiles shown or scheduled. Provide non-corrosive fasteners as recommended by manufacturer for application indicated.

B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.

C. Weather-stripping at Jambs and Heads: Provide bumper-type resilient insert and metal retainer strips, surface-applied unless shown as mortised or semi-mortised, of following metal, finish and resilient bumper material:

1. Rigid Jamb and Head Weatherstrip: Aluminum mill finish, vinyl bulb insert, stainless steel screws. Manufacturers: Pemko 290AV, Reese 815A, Zero International 328A.

D. Weather-stripping at Door Bottoms: Provide threshold consisting of contact type resilient insert and metal housing of design and size shown; of following metal, finish, and resilient seal strip.

1. Door Bottom Sweeps: Clear anodized aluminum finish, neoprene insert, stainless steel screws. Manufacturers: Pemko 368, Zero International 539.

2.12 SEALS

A. Provide seals with the following characteristics:

1. Designed for hollow metal door and frame applications.

2. Seal begins compressing at 3/8". Compresses to seal up to a 1/16" gap.

3. High-temperature silicone; effective between -58°F and 450°F.

4. Self-extinguishing and non-toxic.

5. Unaffected by sunlight, ozone and ultraviolet rays.

6. Impervious to fungus and mildew; will not deteriorate under normal exposure.

7. Smoke tested in accordance with UBC 7-2 and UL 1784-01

8. Meet requirements of NFPA 105 "Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives".

9. Air infiltration tested in accordance with ASTM E-283-04

10. Tested and approved under UL 10C for fire; UL 1784 for smoke

11. Tested and approved under ASTM E90 and BS EN ISO 140-3 for sound control.

B. Acoustic Rated Door Perimeter Seals:

1. Door assembly achieved a minimum 98 percent efficiency rating.

a. Pemko adhesive perimeter seal: S773

b. Pemko automatic door bottom: 411APKL

c. Pemko acoustic corner pad: ACP112

C. Smoke and Fire Seal: Pemko adhesive perimeter seal: S773

D. Split Astragral: Zero 328; Pemco 303; or National 13

2.13 DOOR TOP RAIN SHIELD:

A. Provide only when doors are exposed to rain. Provide 4 inch longer than opening width.

B. Clear anodized aluminum finish, neoprene insert, stainless steel screws.

C. Manufacturers: Pemko 346C, Reese 201A, Zero International.

2.14 THRESHOLDS:

A. Thresholds: Pemko or Zero per compliance with profiles shown on drawings and Miami Dade NOA. Provide all misc. door hardware with threshold to comply with water infiltration resistance test for saddle type threshold, including but not limited to, door seal, door sweep, adjustable stop, and rain drip cap.

B. Threshold (exterior): Aluminum threshold with mill finish, vinyl bulb insert stainless steel screws. Manufacturers: Pemko 2005AV, Zero International #65AV, or Reese #S483AV.

C. Heavy Duty Threshold (exterior): Aluminum threshold with Skid Resistant Surfacing, stainless steel screws. Manufacturers: Pemko 1719AK

D. Barrier Free Ramp Threshold (exterior): Mill Finish Aluminum Aluminum threshold with ramp to provide smooth transition, stainless steel screws. Manufacturers: Pemko 257X259A. Coordinate ramp extension with existing conditions to provide barrier free access.

E. Saddle Threshold: Aluminum mill finish, stainless steel screws. Manufacturers: Pemko 151A, Reese 263A, Zero International 544A.

F. Carpet/Special Purpose Threshold: Aluminum mill finish. Manufacturers: Pemko 2364A, Reese S562A, Zero International 1684A.

2.15 AUTOMATIC DOOR BOTTOM:

A. Full Mortise Style Automatic Door Bottom: Pemko #411 (fire rated doors)

B. Surface Mounted Automatic Door Bottom: Pemko #411 (fire and STC rated doors)

2.16 PANIC EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and ANSI A117.1.

C. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

D. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

E. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

F. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

G. Removable Mullions: BHMA A156.3. Von Duprin 9954 mullion.

H. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.

I. Panic Exit Device Dogging: Except on fire-rated doors, wherever closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to hold the push bar down and the latch bolt in the open position.

J. Electronic Exit Bars: Nonlatching electronic releasing device, activated by an adjustable capacitance sensor, with no moving parts; listed and labeled as panic exit hardware. Fabricate bar from extruded aluminum, and provide door and frame transfer device, all electronic accessories, and 20 feet of cord to route wiring off the door frame.

K. Non-Electrified Panic Exit Device: Von Duprin 99 RIM

1. Primus Everest 7-pin
2. Finishes: 626 – satin chromium plated
3. Latch Bolt: 3/4" throw deadlocking latch.
4. Levers: 17 Lever – 4 3/4" long handle
5. Concealed Vertical Rods

2.17 HARDWARE FINISHES:

A. Provide matching 26D finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.

B. Provide finishes which match those established by BHMA 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 for the applicable units of hardware by referenced standards.

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 in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Mount hardware units at the following heights above finished floor to centerline of item unless otherwise indicated.

1. Hinges: Standard Placement
2. Cylindrical Lockset: 38"
3. Deadlock or Deadlatch: 60"
4. Push Plate: 48"
5. Pull Plate: 42"
6. Panic Bar: 42"
7. Closer: Per manufacturer's template to give maximum degree of opening. Mount closers on room side of door. Provide min. overhead clearance of 80”.
8. Kick Plate: 1/4" from Bottom of door.
9. Stop and Holders:
    a. Wall: On wall where knob or pull hits.
    b. Floor: On floor as far from hinge as conditions permit.
    c. O.H. Door Holder: Per template.
    d. Door Holder: 2" from lead edge of door.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which 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 substrate.

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 which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

F. Electronic Hardware:

1. Install Electrified Magnetic Locks, Power Supply, Electric Power Transfer, and all accessories, and tie to card access control system.
2. Provide card readers and keypads at locations shown on plan.
3. Provide low and high voltage wiring connections.

4. Final connection to access control system and devices shall be by Security System Vendor, or their authorized agent, hired and paid for by the General Contractor.

3.2 ELECTRONIC HARDWARE INTEGRATION

A. The suggested Vendor is listed below to program hardware and perform all software integration for all electrified locksets and devices:

1. A.D.T.
Gino Ezzo
Sr Account Executive
10761 Marks Way, Miramar, FL 330253976
M: 561.696.6075 E:GinoEzzo@adt.com

3.3 ADJUST AND CLEAN:

A. Adjust and check each operating item or hardware and each door, for proper location and to ensure proper operation, function, and keying of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work 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 compensate for final operation of heating and ventilating equipment.

D. Instruct City's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct City's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

F. Upon completion of project the hardware supplier shall furnish two (2) copies of the factory key bitting schedule directly to the City's Representative.

HARDWARE COORDINATION for CONSTRUCTION of CITY FACILITIES

Materials:

External

Internal

Large Format Interchangeable Core (I/C Core) for internal & external during construction

Construction locks must be used during construction utilizing I/C Core cylinders

Process:

1. Two weeks after bid Award General Contractor to schedule a coordination meeting with Facility and City of Delray Beach staff to confirm and stablish a Keying schedule for the project and overall facility.
2. Within the 15 working days after meeting, General contractor to submit Proposed Project Key schedule for City’s review.

3. City will review proposed submitted key schedule and will provide comments within 15 working days.
4. General contractor will address all comments and will use to prepare hardware shop dwgs. submittal. For review and approvals from City.
5. General contractor orders and pays for all the hardware, all temporary and permanent I/C Core Primus Cylinders.
6. At project completion, City will approve, issues cylinders (no Keys) to General contractor for installation.
7. Installation of new I/C Core Primus Cylinders by General Contractor.
8. Allow approximately 10-12 weeks for Hardware & Keying Schedule.

PART 4 - HARDWARE SCHEDULE

A. The following schedule is furnished for whatever assistance it may afford the contractor; do not consider it as entirely inclusive. Should any particular door or item be omitted in any scheduled hardware group, provide door or item with hardware same as required for similar purposes. Quantities listed are for each pair of doors or for each single door.
B. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

C. This hardware schedule prepared by.

Allegion, PLC
3451 Technological Ave, Suite 7
Orlando FL 32817
Ph: 407-571-2000
Fax 407-571-2006

HARDWARE GROUP NO. 01 - EXTERIOR STOREFRONT - PAIR
100B

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	CD-9947-EO-304L	626	VON
1	EA	PANIC HARDWARE	CD-HH-9947-NL-OP-110MD-304L-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX 36-083	626	SCH
3	EA	PRIMUS CORE	20-740	626	SCH
2	EA	90 DEG OFFSET PULL	8190EZHD 10" O	630-316	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	MOUNTING PLATE	4040XP-18	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN

FBC NOA COMPLIANT OPENING
BALANCE OF HARDWARE BY STOREFRONT SUPPLIER

HARDWARE GROUP NO. 02 - EXTERIOR STOREFRONT - PAIR - CARD ACCESS
100A

Provide each PR door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
2 EA POWER TRANSFER EPT10 CON 689 VON
1 EA ELEC PANIC HARDWARE RX-QEL-HH-9947-EO-304L-CON-SNB 24 VDC 626 VON
1 EA ELEC PANIC HARDWARE RX-QEL-HH-9947-NL-OP-110MD-304L-CON-SNB 24 VDC 626 VON
1 EA RIM CYLINDER 20-057 ICX 626 SCH
1 EA PRIMUS CORE 20-740 626 SCH
2 EA 90 DEG OFFSET PULL 8190EZHD 10" O 630-316 IVE
2 EA SURFACE CLOSER 4040XP SCUSH TBSRT 689 LCN
2 EA MOUNTING PLATE 4040XP-18 689 LCN
2 EA CUSH SHOE SUPPORT 4040XP-30 689 LCN
2 EA FLOOR STOP FS444 626 IVE
1 EA CARD READER CARD READER – BY SECURITY SYSTEMS INTEGRATOR UNK
2 EA DOOR CONTACT 679-05HM BLK SCE
1 EA POWER SUPPLY POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR UNK
FBC NOA COMPLIANT OPENING
BALANCE OF HARDWARE BY STOREFRONT SUPPLIER
CARD READER, POWER SUPPLY AND DOOR CONTACTS FURNISHED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 03 - EXTERIOR STOREFRONT - PAIR - CARD ACCESS
202A

Provide each PR door(s) with the following:
QTY DESCRIPTION CATALOG NUMBER FINISH MFR
2 EA POWER TRANSFER EPT10 CON 689 VON
2 EA PANIC HARDWARE CD-9947-EO-304L 626 VON
1 EA ELEC PANIC HARDWARE CD-RX-9947-EO-304L 626 VON
1 EA ELEC EXIT DEVICE TRIM AD-300-993R-70-MT-RHO-J 12/24 VDC 626 SCE
2 EA MORTISE CYLINDER 20-061 ICX 36-083 626 SCH
3 EA PRIMUS CORE 20-740 626 SCH
2 EA SURFACE CLOSER 4040XP SCUSH TBSRT 689 LCN
2 EA MOUNTING PLATE 4040XP-18 689 LCN
2 EA CUSH SHOE SUPPORT 4040XP-30 689 LCN
2 EA FLOOR STOP FS444 626 IVE
FBC NOA COMPLIANT OPENING
BALANCE OF HARDWARE BY STOREFRONT SUPPL
AD-300 EXIT TRIM AND POWER SUPPLY FURNISHED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 04 - EXTERIOR STOREFRONT - SGL
108

Provide each SGL door(s) with the following:
QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1HW 4.5 X 4.5 NRP 630 IVE
1 EA MORTISE CYLINDER 20-061 ICX 36-083 626 SCH
1 EA PRIMUS CORE 20-740 626 SCH
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA MOUNTING PLATE 4040XP-18 689 LCN
FBC NOA COMPLIANT OPENING
LOCK AND BALANCE OF HARDWARE BY STOREFRONT SUPPLIER
VERIFY CYLINDER REQUIREMENTS WITH STOREFRONT SUPPLIER

HARDWARE GROUP NO. 05 - EXTERIOR - GYM/CORRIDOR
100C 101E 101F 101G

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	CD-HH-9927-EO-299F-SNB	626	VON
1	EA	PANIC HARDWARE	CD-HH-9927-L-NL-06-299F-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX 36-083	626	SCH
3	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	RAIN DRIP	11AA		ZER
4	EA	GASKETING	139A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	MEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	8150SBK PSA	BK	ZER
2	EA	DOOR BOTTOM	FAS-SEAL		STE
1	EA	THRESHOLD	566A-223	A	ZER

FBC NOA FL12400_R12 BASIS OF DESIGN

HARDWARE GROUP NO. 06 - EXTERIOR - GYM/CORRIDOR - CARD ACCESS
120

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
2	EA	ELEC PANIC HARDWARE	CD-RX-HH-9947-EO-304L-SNB	626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993R-70-MT-RHO-J 12/24 VDC	626	SCE
3	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	RAIN DRIP	11AA		ZER
4	EA	GASKETING	139A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	MEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	8150SBK PSA	BK	ZER
2	EA	DOOR BOTTOM	FAS-SEAL		STE
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	POWER SUPPLY	POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR		UNK

FBC NOA FL12400_R12 BASIS OF DESIGN

AD-300 EXIT TRIM SUPPLIED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 07 - EXTERIOR - GENERATOR
125A

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	CD-HH-9927-EO-299F-SNB	626	VON
1	EA	PANIC HARDWARE	CD-HH-9927-L-NL-06-299F-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX 36-083	626	SCH
3	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	RAIN DRIP	11AA		ZER

4 EA GASKETING 139A A ZER
1 EA RAIN DRIP 142AA AA ZER
1 SETMEETING STILE 328AA-S AA ZER
1 EA GASKETING 8150SBK PSA BK ZER
2 EA DOOR BOTTOM FAS-SEAL STE
1 EA THRESHOLD 566A-223 A ZER
FBC NOA FL12400_R12 BASIS OF DESIGN

HARDWARE GROUP NO. 08 - EXTERIOR - GENERATOR/ELEC. CARD ACCESS
125B 127
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
2	EA	ELEC PANIC HARDWARE	CD-RX-HH-9927-EO-299F-SNB	626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993S-70-MT-RHO-J 12/24 VDC	626	SCE
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX 36-083	626	SCH
3	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	RAIN DRIP	11AA		ZER
4	EA	GASKETING	139A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1		SETMEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	8150SBK PSA	BK	ZER
2	EA	DOOR BOTTOM	FAS-SEAL		STE
1	EA	THRESHOLD	566A-223	A	ZER
2	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR UNK		

FBC NOA FL12400_R12 BASIS OF DESIGN
AD-300 EXIT TRIM SUPPLIED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 09 - EXTERIOR -SANITIZER - PAIR
123A
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	SURFACE BOLT	SB360 12" T	604	IVE
1	EA	STOREROOM W/DEADBOLT	LV9480T 06A L583-363	630	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	RAIN DRIP	11AA		ZER
5	EA	GASKETING	139A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1		SETMEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	8150SBK PSA	BK	ZER
2	EA	DOOR BOTTOM	FAS-SEAL		STE
1	EA	THRESHOLD	566A-223	A	ZER
2	EA	DOOR CONTACT	679-05HM	BLK	SCE

FBC NOA FL12400_R12 BASIS OF DESIGN
ASTRAGAL BY DOOR SUPPLIER

HARDWARE GROUP NO. 10 - EXTERIOR -STORAGE ROOM - PAIR
S130B S131C

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
2	EA	SURFACE BOLT	SB360 12" T	604	IVE
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-RHO-J 12/24 VDC	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	RAIN DRIP	11AA		ZER
5	EA	GASKETING	139A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	8150SBK PSA	BK	ZER
2	EA	DOOR BOTTOM	FAS-SEAL		STE
1	EA	THRESHOLD	566A-223	A	ZER

FBC NOA FL12400_R12 BASIS OF DESIGN
ASTRAGAL BY DOOR SUPPLIER

HARDWARE GROUP NO. 11 - EXTERIOR -STORAGE ROOM - PAIR - CARD ACCESS
101B 115C1 122 123

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
2	EA	SURFACE BOLT	SB360 12" T	604	IVE
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-RHO-J 12/24 VDC	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	RAIN DRIP	11AA		ZER
5	EA	GASKETING	139A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	8150SBK PSA	BK	ZER
2	EA	DOOR BOTTOM	FAS-SEAL		STE
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	POWER SUPPLY	POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR UNK		

FBC NOA FL12400_R12 BASIS OF DESIGN
ASTRAGAL BY DOOR SUPPLIER
AD-300 LOCK SUPPLIED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 12 - EXTERIOR - MULTIPURPOSE - EXIT - FUTURE CARD ACCESS
115C 200A2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FUTURE POWER TRANSFER	PROVIDE EPT10 PREPERATION FOR FUTURE CARD ACCESS	689	VON
1	EA	PANIC HARDWARE	CD-HH-9975-L-NL-06-SNB	626	VON
2	EA	MORTISE CYLINDER	20-061 ICX 36-083	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	FLOOR STOP	FS436	626	IVE
1	EA	RAIN DRIP	11AA		ZER
1	EA	GASKETING	139A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	DOOR SWEEP	328AA	AA	ZER

1 EA GASKETING 475AA AA ZER
1 EA DOOR BOTTOM FAS-SEAL STE
1 EA THRESHOLD 566A-223 A ZER
FBC NOA FL12400_R12 BASIS OF DESIGN
PROVIDE REGULAR (RA) ARM CLOSER AT OPENING 200A2

HARDWARE GROUP NO. 13 - EXTERIOR - MULTIPURPOSE - EXIT - CARD ACCESS
104A1 104B1 202B
Provide each SGL door(s) with the following:
QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1HW 4.5 X 4.5 NRP 630 IVE
1 EA POWER TRANSFER EPT10 CON 689 VON
1 EA PANIC HARDWARE CD-HH-9975-EO-SNB 626 VON
1 EA ELEC EXIT DEVICE TRIM AD-300-993M-70-MT-RHO-J 12/24 VDC 626 SCE
1 EA MORTISE CYLINDER 20-061 ICX 36-083 626 SCH
2 EA PRIMUS CORE 20-740 626 SCH
1 EA SURFACE CLOSER 4040XP SCUSH TBSRT 689 LCN
1 EA FLOOR STOP FS436 626 IVE
1 EA RAIN DRIP 11AA ZER
1 EA GASKETING 139A A ZER
1 EA RAIN DRIP 142AA AA ZER
1 EA DOOR SWEEP 328AA AA ZER
1 EA GASKETING 475AA AA ZER
1 EA DOOR BOTTOM FAS-SEAL STE
1 EA THRESHOLD 566A-223 A ZER
1 EA POWER SUPPLY POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR UNK
FBC NOA FL12400_R12 BASIS OF DESIGN
AD-300 EXIT TRIM SUPPLIED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 14 - EXTERIOR - STAIR - EXIT
200A1
Provide each SGL door(s) with the following:
QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1HW 4.5 X 4.5 NRP 630 IVE
1 EA PANIC HARDWARE CD-HH-9975-L-06-SNB 626 VON
2 EA MORTISE CYLINDER 20-061 ICX 36-083 626 SCH
2 EA PRIMUS CORE 20-740 626 SCH
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA FLOOR STOP FS436 626 IVE
1 EA RAIN DRIP 11AA ZER
1 EA GASKETING 139A A ZER
1 EA RAIN DRIP 142AA AA ZER
1 EA DOOR SWEEP 328AA AA ZER
1 EA GASKETING 475AA AA ZER
1 EA DOOR BOTTOM FAS-SEAL STE
1 EA THRESHOLD 566A-223 A ZER
FBC NOA FL12400_R12 BASIS OF DESIGN

HARDWARE GROUP NO. 15 - EXTERIOR - LIFEGAURD - CARD ACCESS
121
Provide each SGL door(s) with the following:
QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1HW 4.5 X 4.5 NRP 630 IVE

1 EA POWER TRANSFER EPT10 CON 689 VON
1 EA ELEC CLASSROOM LOCK AD-300-MS-70-MT-RHO-J 12/24 VDC 626 SCE
1 EA PRIMUS CORE 20-740 626 SCH
1 EA SURFACE CLOSER 4040XP SCUSH TBSRT 689 LCN
1 EA RAIN DRIP 11AA ZER
1 EA GASKETING 139A A ZER
1 EA RAIN DRIP 142AA AA ZER
1 EA DOOR SWEEP 328AA AA ZER
1 EA GASKETING 475AA AA ZER
1 EA DOOR BOTTOM FAS-SEAL STE
1 EA THRESHOLD 566A-223 A ZER
1 EA POWER SUPPLY POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR UNK

FBC NOA FL12400_R12 BASIS OF DESIGN
AD-300 LOCK AND POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 16 - EXTERIOR - JANITOR/BUFFER
108A 123B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM W/DEADBOLT	LV9480T 06A L583-363	630	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	RAIN DRIP	11AA		ZER
1	EA	GASKETING	139A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	DOOR SWEEP	328AA	AA	ZER
1	EA	GASKETING	475AA	AA	ZER
1	EA	DOOR BOTTOM	FAS-SEAL		STE
1	EA	THRESHOLD	566A-223	A	ZER

FBC NOA FL12400_R12 BASIS OF DESIGN

HARDWARE GROUP NO. 17 - EXTERIOR - DATA - CARD ACCESS
120B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON 689		VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-RHO-J 12/24 VDC		626 SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	RAIN DRIP	11AA		ZER
1	EA	GASKETING	139A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	DOOR SWEEP	328AA	AA	ZER
1	EA	GASKETING	475AA	AA	ZER
1	EA	DOOR BOTTOM	FAS-SEAL		STE
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	POWER SUPPLY	POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR UNK		

FBC NOA FL12400_R12 BASIS OF DESIGN

AD-300 LOCK AND POWER SUPPLY SUPPLIED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 18 - EXTERIOR - RESTROOM
109 110 111 112 S114A S114B
S114C S114D S114E S114F S131A S131B
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FAC RESTRM W/IND	LV9486T 06A L583-363 L583-375	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	RAIN DRIP	11AA	A	ZER
1	EA	GASKETING	139A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	DOOR SWEEP	328AA	AA	ZER
1	EA	GASKETING	475AA	AA	ZER
1	EA	DOOR BOTTOM	FAS-SEAL		STE
1	EA	THRESHOLD	566A-223	A	ZER

FBC NOA FL12400_R12 BASIS OF DESIGN

HARDWARE GROUP NO. 19 - INTERIOR DOUBLE EGRESS - STOREFRONT
100D 200B 200C
Provide each DE door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	FIRE EXIT HARDWARE	9947-EO-F-304L-SNB	626	VON
2	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
2	EA	MOUNTING PLATE	4040XP-18	689	LCN

BALANCE OF HARDWARE BY STOREFRONT SUPPLIER

HARDWARE GROUP NO. 20 - INTERIOR STOREFRONT - PAIR
101H
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FIRE EXIT HARDWARE	9947-EO-F-304L-SNB	626	VON
1	EA	FIRE EXIT HARDWARE	9947-NL-OP-F-110MD-304L	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	90 DEG OFFSET PULL	8190EZHD 10" O	630-316	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	MOUNTING PLATE	4040XP-18	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN

BALANCE OF HARDWARE BY STOREFRONT SUPPLIER

HARDWARE GROUP NO. 21 - INTERIOR STOREFRONT - PAIR - FUTURE CARD ACCESS
212
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2	EA	FUTURE POWER TRANSFER	PROVIDE EPT10 PREPERATION FOR FUTURE CARD ACCESS	689	VON
1	EA	PANIC HARDWARE	CD-9947-EO-304L	626	VON

1 EA PANIC HARDWARE CD-9947-NL-OP-110MD-304L 626 VON
1 EA RIM CYLINDER20-057 ICX 626 SCH
2 EA MORTISE CYLINDER 20-061 ICX 36-083 626 SCH
3 EA PRIMUS CORE 20-740 626 SCH
2 EA 90 DEG OFFSET PULL 8190EZHD 10" O 630-316 IVE
2 EA SURFACE CLOSER 4040XP SCUSH TBSRT 689 LCN
2 EA MOUNTING PLATE 4040XP-18 689 LCN
2 EA CUSH SHOE SUPPORT 4040XP-30 689 LCN
BALANCE OF HARDWARE BY STOREFRONT SUPPLIER
PREP DOOR/FRAME FOR FUTIRE ADDTION OF AD-300 ACCESS CONTROL LOCK. PREP DOOR AND FRAME FOR EPT10 AND RACEWAY IN THE DOOR.
PROVIDE BLANK COVER PLATES FOR EPT PREP.

HARDWARE GROUP NO. 22 - INTERIOR STOREFRONT - SGL - FUTURE CARD ACCESS
118A 200A
Provide each SGL door(s) with the following:
QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1 4.5 X 4.5 652 IVE
1 EA FUTURE POWER TRANSFER PROVIDE EPT10 PREPERATION FOR FUTURE CARD ACCESS 689 VON
1 EA PANIC HARDWARE CD-9947-NL-OP-110MD-304L 626 VON
1 EA RIM CYLINDER20-057 ICX 626 SCH
1 EA MORTISE CYLINDER 20-061 ICX 36-083 626 SCH
2 EA PRIMUS CORE 20-740 626 SCH
1 EA 90 DEG OFFSET PULL 8190EZHD 10" O 630-316 IVE
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA MOUNTING PLATE 4040XP-18 689 LCN
BALANCE OF HARDWARE BY STOREFRONT SUPPLIER
PREP DOOR/FRAME FOR FUTIRE ADDTION OF AD-300 ACCESS CONTROL LOCK. PREP DOOR AND FRAME FOR EPT10 AND RACEWAY IN THE DOOR.
PROVIDE BLANK COVER PLATES FOR EPT PREP.

HARDWARE GROUP NO. 23 - INTERIOR STOREFRONT - SGL - CARD ACCESS
102A 116E
Provide each SGL door(s) with the following:
QTY DESCRIPTION CATALOG NUMBER FINISH MFR
4 EA HINGE 5BB1HW 4.5 X 4.5 652 IVE
1 EA POWER TRANSFER EPT10 CON 689 VON
1 EA ELEC CLASSROOM LOCK AD-300-MS-70-MT-RHO-J 12/24 VDC 626 SCE
1 EA PRIMUS CORE 20-740 626 SCH
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA MOUNTING PLATE 4040XP-18 689 LCN
1 EA POWER SUPPLY POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR UNK
BALANCE OF HARDWARE BY STOREFRONT SUPPLIER
AD-300 LOCK SUPPLIED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 24 - INTERIOR EXIT ONLY - RATED
200E 200F
Provide each PR door(s) with the following:
QTY DESCRIPTION CATALOG NUMBER FINISH MFR
6 EA HINGE 5BB1 4.5 X 4.5 652 IVE
2 EA FIRE EXIT HARDWARE 9947-EO-F-304L-SNB 626 VON
2 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN

2 EA KICK PLATE 8400 10" X 2" LDW B-CS630 IVE
2 EA FIRE/LIFE WALL MAG SEM7850 AS REQ (12/24/120V AC/DC TRI-VOLT) 689 LCN
1 EA GASKETING 328AA AA ZER
1 SETMEETING STILE 328AA-S AA ZER

HARDWARE GROUP NO. 25 - INTERIOR EXIT - NON-RATED - CARD ACCESS
204

Provide each PR door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
6 EA HINGE 5BB1 4.5 X 4.5 652 IVE
2 EA ELEC PANIC HARDWARE CD-RX-9947WDC-EO-CON-SNB 626 VON
1 EA ELEC EXIT DEVICE TRIM AD-300-993R-70-MT-RHO-J 12/24 VDC 626 SCE
2 EA MORTISE CYLINDER 20-061 ICX 36-083 626 SCH
3 EA PRIMUS CORE 20-740 626 SCH
2 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
2 EA KICK PLATE 8400 10" X 2" LDW B-CS630 IVE
2 EA WALL STOP WS406/407CVX 630 IVE
1 EA GASKETING 328AA AA ZER
1 SETMEETING STILE 328AA-S AA ZER
1 EA POWER SUPPLY POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR UNK
1 PROVIDE FACTORY POINT TO POINT WIRING DIAGRAMS
AD-300 EXIT TRIM AND POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 26 - INTERIOR PAIR - NON-RATED - FUTURE CARD ACCESS
115C2

Provide each PR door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
6 EA HINGE 5BB1 4.5 X 4.5 652 IVE
1 EA FUTURE POWER TRANSFER PROVIDE EPT10 PREPERATION FOR FUTURE CARD ACCESS 689 VON
1 EA AUTO FLUSH BOLT FB31P 630 IVE
1 EA CLASSROOM LOCK LV9070T 06A 626 SCH
1 EA PRIMUS CORE 20-740 626 SCH
1 EA COORDINATOR COR X FL 628 IVE
2 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
2 EA WALL STOP WS406/407CVX 630 IVE
2 EA SILENCER SR64 GRY IVE
ASTRAGAL BY DOOR SUPPLIER
PREP DOOR/FRAME FOR FUTURE ADDTION OF AD-300 ACCESS CONTROL LOCK. PREP DOOR AND FRAME FOR EPT10 AND RACEWAY IN THE DOOR.
PROVIDE BLANK COVER PLATES FOR EPT PREP.

HARDWARE GROUP NO. 27 - INTERIOR STORAGE - PAIR HM NON-RATED - CARD ACCESS
101A

Provide each PR door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
6 EA HINGE 5BB1 4.5 X 4.5 652 IVE
2 EA POWER TRANSFER EPT10 CON 689 VON
1 EA AUTO FLUSH BOLT FB31P 630 IVE
1 EA ELEC CLASSROOM LOCK AD-300-MS-70-MT-RHO-J 12/24 VDC 626 SCE
1 EA PRIMUS CORE 20-740 626 SCH
1 EA COORDINATOR COR X FL 628 IVE
2 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN

2 EA WALL STOP WS406/407CVX 630 IVE
2 EA SILENCER SR64 GRY IVE
ASTRAGAL BY DOOR SUPPLIER
AD-300 LOCK SUPPLIED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 28 - INTERIOR STORAGE - WD NON-RATED - CARD ACCESS
205B

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	AUTO FLUSH BOLT	FB41P	630	IVE
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-RHO-J 12/24 VDC	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CVX	630	IVE
2	EA	SILENCER	SR64 GRY		IVE

ASTRAGAL BY DOOR SUPPLIER
AD-300 LOCK SUPPLIED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 29 - INTERIOR EXIT - RATED
118

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	99-L-F-06-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	328AA AA		ZER

HARDWARE GROUP NO. 30 - INTERIOR EXIT - RATED - CARD ACCESS
208A 208B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	FIRE EXIT HARDWARE	99-EO-F-SNB	626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993R-70-MT-RHO-J 12/24 VDC	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	328AA AA		ZER

AD-300 EXIT TRIM SUPPLIED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 31 - INTERIOR EXIT - NON-RATED
200D

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE

1 EA PANIC HARDWARE CD-99-L-06-SNB 626 VON
1 EA RIM CYLINDER20-057 ICX 626 SCH
1 EA MORTISE CYLINDER 20-061 ICX 36-083 626 SCH
2 EA PRIMUS CORE 20-740 626 SCH
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA KICK PLATE 8400 10" X 2" LDW B-CS630 IVE
1 EA WALL STOP WS406/407CVX 630 IVE
3 EA GASKETING 328AA AA ZER

HARDWARE GROUP NO. 32 - INTERIOR EXIT - NON-RATED
216A 216D

Provide each SGL door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1 4.5 X 4.5 652 IVE
1 EA FUTURE POWER TRANSFER PROVIDE EPT10 PREPERATION FOR FUTURE CARD ACCESS 689 VON
1 EA PANIC HARDWARE CD-99-L-06-SNB 626 VON
1 EA RIM CYLINDER20-057 ICX 626 SCH
1 EA MORTISE CYLINDER 20-061 ICX 36-083 626 SCH
2 EA PRIMUS CORE 20-740 626 SCH
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA KICK PLATE 8400 10" X 2" LDW B-CS630 IVE
1 EA WALL STOP WS406/407CVX 630 IVE
3 EA GASKETING 328AA AA ZER

HARDWARE GROUP NO. 33 - INTERIOR - RATED - CARD ACCESS
115 116 211

Provide each SGL door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1 4.5 X 4.5 652 IVE
1 EA POWER TRANSFER EPT10 CON 689 VON
1 EA ELEC CLASSROOM LOCK AD-300-MS-70-MT-RHO-J 12/24 VDC 626 SCE
1 EA PRIMUS CORE 20-740 626 SCH
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA KICK PLATE 8400 10" X 2" LDW B-CS630 IVE
1 EA WALL STOP WS406/407CVX 630 IVE
1 EA GASKETING 328AA AA ZER
1 EA POWER SUPPLY POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR UNK

AD-300 LOCK SUPPLIED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 34 - INTERIOR - RATED - FUTURE CARD ACCESS
119

Provide each SGL door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1 4.5 X 4.5 652 IVE
1 EA FUTURE POWER TRANSFER PROVIDE EPT10 PREPERATION FOR FUTURE CARD ACCESS 689 VON
1 EA CLASSROOM LOCK LV9070T 06A 626 SCH
1 EA PRIMUS CORE 20-740 626 SCH
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA KICK PLATE 8400 10" X 2" LDW B-CS630 IVE
1 EA WALL STOP WS406/407CVX 630 IVE
1 EA GASKETING 328AA AA ZER

PREP DOOR/FRAME FOR FUTURE ADDTION OF AD-300 ACCESS CONTROL LOCK. PREP DOOR AND FRAME FOR EPT10 AND RACEWAY IN THE DOOR.
PROVIDE BLANK COVER PLATES FOR EPT PREP.

HARDWARE GROUP NO. 35 - INTERIOR STORAGE - NON-RATED - FUTURE CARD ACCESS
120A1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FUTURE POWER TRANSFER	PROVIDE EPT10 PREPERATION FOR FUTURE CARD ACCESS	689	VON
1	EA	STOREROOM LOCK	LV9080T 06A	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

PREP DOOR/FRAME FOR FUTIRE ADDTION OF AD-300 ACCESS CONTROL LOCK. PREP DOOR AND FRAME FOR EPT10 AND RACEWAY IN THE DOOR.
PROVIDE BLANK COVER PLATES FOR EPT PREP.

HARDWARE GROUP NO. 36 - INTERIOR STORAGE - NON-RATED
120A2 126 204A 206 210B 216A1
216A2 216C

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	LV9080T 06A	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 37 - INTERIOR - NON-RATED - CARD ACCESS
102B 105 106 115A 115B 203A
205A 210A 216B 217

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-RHO-J 12/24 VDC	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	FSIC CORE	23-030 ICX	622	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	POWER SUPPLY	POWER SUPPLY BY SECURITY SYSTEMS INTEGRATOR		UNK

AD-300 LOCK SUPPLIED BY THE SECURITY SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 38 - INTERIOR MULTI-PURPOSE - RATED
210

Provide each SGL door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1 4.5 X 4.5 652 IVE
1 EA CLASSROOM LOCK LV9070T 06A 626 SCH
1 EA PRIMUS CORE 20-740 626 SCH
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA KICK PLATE 8400 10" X 2" LDW B-CS630 IVE
1 EA WALL STOP WS406/407CVX 630 IVE
1 EA GASKETING 328AA AA ZER

HARDWARE GROUP NO. 39 - INTERIOR CONFERENCE/MULTI-PURPOSE - RATED - FUTURE CARD ACCESS
104A2 104B2 209

Provide each SGL door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1 4.5 X 4.5 652 IVE
1 EA FUTURE POWER TRANSFER PROVIDE EPT10 PREPERATION FOR FUTURE CARD ACCESS 689 VON
1 EA CLASSROOM LOCK LV9070T 06A 626 SCH
1 EA PRIMUS CORE 20-740 626 SCH
1 EA FSIC CORE 23-030 ICX 622 SCH
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA KICK PLATE 8400 10" X 2" LDW B-CS630 IVE
1 EA WALL STOP WS406/407CVX 630 IVE
3 EA GASKETING 328AA AA ZER

PREP DOOR/FRAME FOR FUTIRE ADDTION OF AD-300 ACCESS CONTROL LOCK. PREP DOOR AND FRAME FOR EPT10 AND RACEWAY IN THE DOOR.
PROVIDE BLANK COVER PLATES FOR EPT PREP.

HARDWARE GROUP NO. 40 - INTERIOR KITCHEN/STAFF - NON-RATED
203B

Provide each SGL door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1HW 4.5 X 4.5 652 IVE
1 EA CLASSROOM LOCK LV9070T 06A 626 SCH
1 EA PRIMUS CORE 20-740 626 SCH
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA KICK PLATE 8400 10" X 2" LDW B-CS630 IVE
1 EA WALL STOP WS406/407CVX 630 IVE
3 EA SILENCER SR64 GRY IVE

HARDWARE GROUP NO. 41 - INTERIOR OFFICE - NON-RATED
116A 116B 116C 116D 120C

Provide each SGL door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1 4.5 X 4.5 652 IVE
1 EA CLASSROOM LOCK LV9070T 06A 626 SCH
1 EA PRIMUS CORE 20-740 626 SCH
1 EA WALL STOP WS406/407CVX 630 IVE
3 EA SILENCER SR64 GRY IVE

HARDWARE GROUP NO. 42 - INTERIOR RESTOOMS - SINGLE USE
117 120D 121A 213

Provide each SGL door(s) with the following:

QTY DESCRIPTION CATALOG NUMBER FINISH MFR
3 EA HINGE 5BB1 4.5 X 4.5 652 IVE

1 EA PRIVACY LOCK LV9040 06A L583-363 L283-722 626 SCH
1 EA SURFACE CLOSER 4040XP REG OR PA AS REQ TBSRT 689 LCN
1 EA KICK PLATE 8400 10" X 2" LDW B-CS630 IVE
1 EA WALL STOP WS406/407CVX 630 IVE
3 EA SILENCER SR64 GRY IVE

HARDWARE GROUP NO. 43 - INTERIOR RESTOOMS
101C 101D 107 113 120E 120F
214 215

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA PUSH PLATE	8200 4" X 16"	630	IVE
1	EA PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA KICK PLATE	8400 10" X 2" LDW B-CS630	IVE	
1	EA WALL STOP	WS406/407CVX	630	IVE
3	EA SILENCER	SR64	GRY	IVE

PART 5 - DOOR INDEX

Door Numbers	HwSet#
100A	02
100B	01
100C	05
100D	19
101A	27
101B	11
101C	43
101D	43
101E	05
101F	05
101G	05
101H	20
102A	23
102B	37
104A1	13
104A2	39
104B1	13
104B2	39
105	37
106	37
107	43
108	04
108A	16
109	18
110	18
111	18
112	18

Door Numbers	HwSet#
113	43
115	33
115A	37
115B	37
115C	12
115C1	11
115C2	26
116	33
116A	41
116B	41
116C	41
116D	41
116E	23
117	42
118	29
118A	22
119	34
120	06
120A1	35
120A2	36
120B	17
120C	41
120D	42
120E	43
120F	43
121	15
121A	42

Door Numbers	HwSet#
122	11
123	11
123A	09
123B	16
125A	07
125B	08
126	36
127	08
130A	
130C	
130D	
130E	
130F	
200A	22
200A1	14
200A2	12
200B	19
200C	19
200D	31
200E	24
200F	24
202A	03
202B	13
203A	37
203B	40
204	25
204A	36

Door Numbers	HwSet#
205A	37
205B	28
206	36
208A	30
208B	30
209	39
210	38
210A	37
210B	36
211	33
212	21

Door Numbers	HwSet#
213	42
214	43
215	43
216A	32
216A1	36
216A2	36
216B	37
216C	36
216D	32
217	37
S114A	18

Door Numbers	HwSet#
S114B	18
S114C	18
S114D	18
S114E	18
S114F	18
S130B	10
S131A	18
S131B	18
S131C	10

PART 6 - CARD READERS

Door Number	Room Number	Location	Type	Mounting	Transfer Hinge	1st floor Data Room
121	121		AD-300			
125B	125	Generator Room	AD-300	Door	Yes	1st floor Data Room
127	127	Electrical Room	AD-300	Door	Yes	1st floor Data Room
101B	101B	Sports Equipment Room	AD-300	Door	Yes	1st floor Data Room
122	122	Pool Storage	AD-300	Door	Yes	1st floor Data Room
100A	Main Entry Lobby	Main Entrance Double Store Front Dr	Card / Pin	Wall	No	1st floor Data Room
115C1	115C	Receiving Entrance	AD-300	Door	Yes	1st floor Data Room
123	123	Pool Pump Room	AD-300	Door	Yes	1st floor Data Room
106	106	Mechanical Room 106	AD-300	Door	Yes	1st floor Data Room
104B1	104B		AD-300			
104B2	104B		FUTURE			
104A1	104A		AD-300			
104A2	104A		FUTURE			
104B	104B	Multi-Purpose room	AD-300	Door	Yes	1st floor Data Room
104B	104B	Multi Purpose room-South Door	Future			1st floor Data Room
104A	104A	Multi-Purpose room	Future			1st floor Data Room

105	105	Storage 105	AD-300	Door	Yes	4th floor Data Room
102A	102	Play room Entrance	AD-300	Door	Yes	5th floor Data Room
115	115	Teen Room	AD-300	Door	Yes	6th floor Data Room
115A	115A	Storage 115 A	AD-300	Door	Yes	7th floor Data Room
115B	115B	Office 115 B	AD-300	Door	Yes	8th floor Data Room
115C	115C	Receiving Interior Double Doors	Future			
116E	100A	Reception to Admin	AD-300	Door	Yes	9th floor Data Room
116	116	Commons to Admin	AD-300	Door	Yes	10th floor Data Room
119	119	Kitchen Door	Future			11th floor Data Room
120B	120B	Exterior door to Data	AD-300	Door	Yes	1st floor Data Room
120A1	120B		Future			
120B	120B	Interior door to data	Future			Interior Door
120	120	Exterior After School Door	AD-300	Door	Yes	1st floor Data Room
120	120	Interior After Care Door	Future			2nd floor Data Room
118A	120		Future			
216A	216		Future			
216D	216		Future			
216	216	Dance/Aerobics West Door	Future			2nd floor Data Room
216	216	Dance/Aerobics East Door	Future			2nd floor Data Room
216B	216B	Second Floor Data	AD-300	Door	Yes	2nd Floor Data Room
210A	210A	Storage 210 A	AD-300	Door	Yes	2nd Floor Data Room
212	212	Fitness Room Double Doors	Future			2nd floor Data Room
211	211	Janitor Closet	Future			2nd floor Data Room
201	201	Track Door	Future			2nd floor Data Room
217	217	Staff Lounge	AD-300	Door	Yes	2nd Floor Data Room
205B	205	Storage 205 West	AD-300	Door	Yes	2nd Floor Data Room
205A	205	Storage 205 East	AD-300	Door	Yes	2nd Floor Data Room
204	204	Auditorium Main Entrance	AD-300	Door	Yes	2nd Floor Data

						Room
202	202	Covered Terrace Double Door	Future			2nd floor Data Room
202B	204	Auditorium Rear Corridor	AD-300	Door	Yes	2nd Floor Data Room
203A	203	Kitchen Door	AD-300	Door	Yes	2nd Floor Data Room
208A	208A	Multi Purpose Senior "C"	AD-300	Door	Yes	2nd Floor Data Room
208B	208B	Multi Purpose Senior "B"	AD-300	Door	Yes	2nd Floor Data Room
209	209	Conference Room	Future			2nd floor Data Room
202A	202	Terrace Entrance	AD-300	Door	Yes	2nd Floor Data Room
200A	200A	Vestibule Exterior	Future			2nd floor Data Room
200A2	200A	Vestibule Interior	Future			2nd floor Data Room
101A	101A	Storage 101 A	AD-300	Door	Yes	1st floor Data Room
102B	102		AD-300			

END OF SECTION

SECTION 088000 - GLAZING

PART 1 – GENERAL

1.1 SUMMARY

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

B. Section Includes:

1. Transparent and translucent glass glazing for general and special purpose applications including; coated, float, heat-strengthened, impact resistant, insulating, low emissivity, laminated, spandrel and tempered glass.

2. Work Results: Manufacture, handle, deliver and install glazing systems as shown on the architectural drawings or as otherwise specified and in accordance with the requirements of the contract documents.

1.2 REFERENCES

A. Abbreviations and Acronyms:

1.	AAMA	American Architectural Manufacturers Association
2.	ANSI	American National Standards Institute
3.	ASTM	Formerly the American Society for Testing and Materials
4.	CPSC	Consumer Products Safety Commission
5.	FGBC	Florida Green Building Coalition
6.	FT	Fully Tempered
7.	GANA	Glass Association of North America
8.	HS	Heat-strengthened
9.	ICC	International Code Council
10.	IGCC	Insulating Glass Certification Council
11.	IGMA	Insulating Glass Manufacturers Alliance
12.	LBNL	Lawrence Berkeley National Laboratories
13.	LEED	Leadership in Energy & Environmental Design
14.	Low-E	Low emissivity
15.	LSG	Light to Solar Gain
16.	NFRC	National Fenestration Rating Council
17.	SHGC	Solar Heat Gain Coefficient
18.	SC	Shading Coefficient
19.	USGBC	The U.S. Green Building Council
20.	VLT	Visible Light Transmittance

B. Definitions:

1. Deterioration of Coated Glass: Defects developing from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to

manufacturer's written instructions. Defects include peeling, cracking and other indications of deterioration in metallic coating.

2. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture or film on interior surfaces of glass.

3. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delaminating material obstructing vision through glass and blemishes exceeding those allowed by referenced laminated glass standards.

4. Interspace or Airspace: The space between lites of any insulating glass unit that contains dehydrated air or a specified gas.

5. Manufacturer: A firm that produces primary glass or fabricated glass products as defined in referenced glazing publications.

C. Reference Standards: This section requires compliance with the following standards.

1. ASTM C 1036 Standard Specification for Flat Glass

2. ASTM C 1048 Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated

3. ASTM C 1172 Standard Specification for Laminated Architectural Flat Glass

4. ASTM C 1376 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass

5. ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation *(replaces ASTM E773, E774 CBA, CAN / CGSB 12.8)*

6. ASTM E 546 Standard Test Method for Frost Point of Sealed Insulating Glass Units

7. ASTM E 576 Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position

8. ASTM E 1300 Standard Practice for Determining Load Resistance of Glass in Buildings

9. ASTM C 1349 Standard Specification for Architectural Flat Glass Clad Polycarbonate

10. ANSI Z97.1 Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings

11. CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials

1.3 SUBMITTALS

A. Shop Drawings: Show details of each type of glazing system in conjunction with the framing system indicating type of glass, sizes, shapes, glazing material and quantity. Show details indicating glazing material, glazing thickness, bite on the glass and glass edge clearance.

B. Samples: Submit 12-inch (305 mm) long samples of each type of glass indicated and 12-inch (305 mm) long samples of each color required for each type of sealant or gasket exposed to view.

C. Test and Evaluation Reports: Glazing contractor shall obtain compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealant as well as other glazing materials including insulating units.

D. Manufacturer Reports: Submit Glass Fabricator's Shop Drawing Review indicating compliance with glazing standards established by the Glass Association of North America (GANA). Submittal to include thermal stress and structural load analysis of the proposed glass types, configuration and sizes.

E. Sustainable Design Submittals: Submit manufacturer's documentation verifying product content, origin or other attributes for projects requiring special sustainability provisions, to meet the FGBC's requirements or other sustainable goals.

F. Submit test reports signed and sealed by an independent P.E. certifying glazing system compliance for "wind-born debris" protection provisions per ASTM E 1996 / 1886 and the latest Florida Building Code (2020)

G. Warranties:

1. Provide a written 10-year warranty from date of manufacture for sputter coated glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.

2. Provide a written 10-year warranty from date of manufacture for laminated glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.

3. Provide a written 10-year warranty from date of manufacture for ceramic frit. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: Fabrication processes, including low emissivity and reflective coatings, insulating, laminated, silk-screening and tempering shall be manufactured by a single manufacturer with a minimum of ten (10) years of fabrication experience and meet ANSI / ASQC 9002 1994.

B. Mock-ups: Before glazing, build mockups for each glass product indicated in section 2.5 Product Schedule to verify selections and to demonstrate aesthetic effects and qualities of materials and execution.

1. Construction: Build mockups with glass and glazing systems specified for the project, including typical lite size, framing systems and glazing methods.

2. Scheduling: Notify architect seven days in advance of dates and times when mockups will be available for viewing.

3. Quality Assurance: Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work. Accepted mockups may become part of the completed work if undisturbed at the time of substantial completion.

C. Publications: Comply with recommendations in the publications below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or in Article 1.2 References.

1. GANA Glazing Manual

2. GANA Engineering Standards Manual

3. GANA Laminated Glazing Reference Manual

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage and Handling Requirements:

1. Protect glass from edge damage during handling. For insulating units exposed to substantial altitude changes, comply with insulating glass manufacturers written recommendations for venting and sealing to avoid hermetic seal ruptures.

2. Storage and Protection: Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun or other causes.

1.6 SITE CONDITIONS

A. Ambient Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by the 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°F (4.4°C).

PART 2 – PRODUCTS

2.1 MANUFACTURERS/FABRICATORS

A. Basis of Design: Viracon

Alternative source supplier (s) subject to Architect prior bid approval demonstrating equivalent visual characteristics, solar performance and compliance with all requirements specified herein:

B. Substitution Limitations: In some cases, it may be necessary to use the specified product without substitution, either to match work-in-place or to match similar products used in another facility or for another reason determined by the City. Confirm constraints with the City or other Authority Having Jurisdiction.

C. Product Options: Obtain glass and glazing materials from one source for each product indicated. Coatings and finished assemblies, such as insulating units and laminated units, to be manufactured by the same fabricator in order to have a common source of warranty.

2.2 DESCRIPTION

A. Provide glazing systems capable of withstanding normal thermal movements, wind loads and impact loads, without failure, including loss due to defective manufacture, fabrication and installation; deterioration of glazing materials; and other defects in construction.

2.3 PERFORMANCE / DESIGN CRITERIA

A. Glass Strength: Analysis shall comply with ASTM E 1300 Determining Load Resistance of Glass in Buildings. Provide glass products in the thickness and strengths (annealed or heat-treated) required to meet or exceed the following criteria based on project loads and in-service conditions.

1. Minimum thickness of annealed or heat-treated glass products to be selected so the worst case probability of failure does not exceed the following:

a. 8 breaks per 1000 for glass installed vertically or not 15 degrees or more from the vertical plane and under wind action.

b. 1 break per 1000 for glass installed 15 degrees or more from the vertical plane and under action of wind and/or snow.

2. Deflection must be limited to prevent disengagement from the frame and be less than or equal to 1" (25mm).

B. Thermal and Optical Performance: Provide glass products with performance properties specified in 2.5 Product Schedule. Performance properties to be manufacturer's published data as determined according to the following procedures:

1. Center of glass U-Value: NFRC 100 methodology using LBNL WINDOW 5.2 computer program.

2. Center of glass solar heat gain coefficient: NFRC 200 methodology using LBNL-35298 WINDOW 5.2 computer program.

3. Solar optical properties: NFRC 300

C. Provide glazing systems tested and certified to meet ASTM E 1996 / 1886 and the latest Florida Building Code (2020)

2.4 FABRICATION

A. Flat Glass:

1. Shall comply with ASTM C1036 Standard Specification for Flat Glass, Type 1, Class 1 (clear) or Class 2 (tint) and Quality q3

2. ASTM C 1048 Heat Treated Flat Glass, Kind HS or FT, B (spandrel glass, one surface coated), or C (other coated) glass

a. Heat Treated Flat Glass to be by horizontal (roller hearth) process with inherent rollerwave distortion parallel to the bottom edge of the glass as installed.

b. Maximum peak to valley rollerwave 0.003" (0.08mm) in the central area and 0.008" (0.20mm) within 10.5" (267mm) of the leading and trailing edge.

c. Maximum bow and warp 1/32" per lineal foot (0.79mm).

d. Millidiopter (mD) output for heat treated glass (6mm or thicker) would be 95% <100mD

e. All tempered architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.

C. Laminated Glass:

1. Shall comply with ASTM 1172 Standard Specification for Laminated Architectural Flat Glass.

2. All laminated architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.

3. Laminated Glass products to be fabricated free of foreign substances and air or glass pockets in autoclave with heat plus pressure.

D. Coated Vision Glass:

1. Shall comply with ASTM C 1376 Standard for Pyrolytic and Vacuum Deposition Coatings on Glass

2. Coated products to be magnetically sputtered vacuum deposition (MSVD)

3. Edge Deletion – When low-e coatings are used within an insulating unit, coating shall be edge deleted to completely seal the coating within the unit.

a. The edge deletion should be uniform in appearance (visually straight) and remove 95% of the coating.

E. Ceramic Coated Glass Products:

1. Shall comply with ASTM C 1048 Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated, Condition B

2. Silk-screen pattern should be no more than 0.0625" (1.59 mm) off parallel from locating glass edge and no more than 0.0125" (3.18 mm) from edges other than locating glass edge.

3. There shall be a maximum of a 0.03125" (0.79 mm) variation in dot, hole or line location.

2.5 ACCESSORIES

A. Glazing Materials: Select glazing sealants, tapes, gaskets and additional glazing materials of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

1. Setting blocks to be 100% silicone

2.6 PRODUCT SCHEDULE

A. Hurricane Resistant Insulating Laminated Low E Coated Glass:

1. Viracon VE1-42 Basis of Design

a. Exterior Glass Ply: ¼" Clear Tempered

b. Coating: VE-42 Blue tone low e on #2 surface

c. Space: ½" VTS, black finish

d. Silicone: black

e. Interior Glass Ply 1: Clear Heat Strengthened

f. Laminate Interlayer: select kind and thickness as tested in the Assembly Florida Product Approval

g. Interior Glass Ply 2: ¼" Clear Heat Strengthened

1. Performance Requirements

a. Visible Light Transmittance 36%

b. Exterior Reflectance 19%

c. Winter U-Value 0.26

d. Summer U-Value 0.24

e. Solar Heat Gain Coefficient 0.30

f. Light to Solar Gain Ratio 1.20

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Verify prepared openings for glazing are correctly sized and within tolerance. Verify that the minimum required face and edge clearances are being followed.

2. Verify that a functioning weep system is present.

3. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Immediately before glazing, clean glazing channels and other framing members receiving glass. Remove coatings not firmly bonded to substrates.

B. Demolition / Removal: Remove and replace glass that is broken, chipped, cracked or damaged in any way.

3.3 INSTALLATION

A. Install products using the recommendations of manufacturers of glass, sealants, gaskets and other glazing materials including those in the GANA Glazing Manual except where more stringent requirements are indicated.

B. Prevent glass from contact with contaminating substances that result from construction operations such as weld splatter, fire-safing or plastering.

3.4 CLEANING

A. Clean excess sealant or compound from glass and framing members immediately after application using solvents or cleaners recommended by manufacturers.

END OF SECTION

SECTION 092216.13 – NON-STRUCTURAL METAL STUD FRAMING SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed metal stud framing at interior locations.

B. Framing accessories.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. ASTM A525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

B. ANSI/ASTM A591 - Steel Sheet, Cold-Rolled, Electrolytic Zinc-Coated.

C. ASTM C645 – Non-Load (Axial) Bearing Steel Studs, Runners (Track) and Rigid Furring Channels for Screw Application of Gypsum Board.

D. ASTM A 641/A 641M - Standard Specification for Zinc- Coated (Galvanized) Carbon Steel Wire.

E. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

F. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

G. ASTM A875/A875M - Standard Specification for Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot-Dip Process.

H. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.

I. ASTM A 1003/A 1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

J. ASTM A1046 - Standard Specification for Steel Sheet, Zinc-Aluminum-Magnesium Alloy-Coated by the Hot-Dip Process.

K. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board.

L. ASTM C 841 - Standard Specification for Installation of Interior Lathing and Furring.

M. ASTM C 844 - Standard Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster.

N. ASTM C 1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.

O. ASTM E 413 - Classification for Rating Sound Insulation.

P. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

Q. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

R. ASTM E 488/E 488M - Standard Test Methods for Strength of Anchors in Concrete Elements.

S. ASTM E 1190 - Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members.

T. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.

1.03 SYSTEM DESCRIPTION

A. Metal stud framing system for interior walls, consisting of top and bottom tracks, studs and supports to structure.

B. Maximum Allowable Deflection: 1/360 span.

C. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.04 SUBMITTALS

A. Submit shop drawings indicating component details, framed openings, anchorage to structure, type and location of fasteners, and accessories or items required of other related work.

B. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement to framing connections.

C. Submit product data.

D. Submit product data describing standard framing member materials and finish, product criteria, load charts and limitations.

E. Submit manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with ASTM C754.

B. Maintain one copy of each document on site.

C. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.

D. Installer Qualifications: Minimum 2 year experience installing similar products.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.

2. Do not proceed with remaining work until workmanship is approved by Architect.

3. Rebuild mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE, HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.07 PRE-INSTALLATION CONFERENCE

A. Convene one week prior to commencing work of this Section.

B. Coordinate construction of mock-up with related Sections.

1.08 SEQUENCING AND SCHEDULING

A. Sequence work with other work directly affected by this Section.

B. Coordinate the work of related Sections.

1.09 CODE

A. Comply with the requirements of the Florida Building Code, 2020 Latest Edition.

PART 2 PRODUCTS

2.01 PREORMANCE REQUIREMENTS

A. Comply 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. Horizontal Deflection: For wall assemblies, limited based on cladding listed below and a horizontal loading of 5 lbf/sf (24 kilogram-force/square meter). Overall deflection shall be limited to:

1. Gypsum board finishes: 1/120 of wall height.
2. Metal panel systems: 1/180 of wall height.
3. Gypsum board with critical or brittle paint finishes: 1/240 of wall height.
4. Tile or stucco or veneer plaster or thin brick: 1/360 of wall height.
5. Brick or stone or masonry veneer: 1/600 of wall height.

2.02 STUD FRAMING MATERIALS

A. Studs: ASTM A525, galvanized to G90 coating class, ANSI/ASTM A591, electrogalvanized, non-load bearing rolled steel, channel shaped, punched for utility access, as scheduled. Minimum 25 GA for partitions with 20 GA at all doors, windows, openings, etc. except as noted otherwise on plans. See UL fire rating assembly as shown on plans for compliance with minimum gauge at fire rated walls. See plans for minimum gauge of selected framing members.

B. Runners: Of same material and finish as studs, bent leg retainer notched to receive studs.

C. Furring and Bracing Members: Of same material and finish as studs, thickness to suit purpose.

D. Fasteners: GA 203. Self-drilling, self-tapping screws.

E. Metal Backing: 20 gage galvanized steel.

F. Anchorage Devices: Power driven. Powder actuated or drilled expansion bolts. Comply with GA-203.

G. Primer: FSTT-P-645, for touch-up of galvanized surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are ready to receive work.

B. Verify field measurements are as shown on Drawings.

C. Verify that rough-in utilities are in proper location.

D. Beginning of installation means installer accepts existing conditions.

3.02 ERECTION

A. Align and secure top and bottom runners at 16” inches O.C. . Place two beads of sealant between runners and substrate. Achieve air seal between runners and substrate.

B. Fit runners under and above openings; secure intermediate studs at spacing of wall studs.

C. Install studs vertically at 16 inches O.C. Achieve air seal between studs and adjacent vertical surfaces.

D. Connect studs to tracks using fastener method.

E. Stud splicing not permissible, except if approved in writing by Architect prior to bid.

F. Construct corners using minimum three studs.

G. Double studs at wall openings, door and window jambs, at connection to 1 hr Rated enclosed columns, not more than 2 inches each side of openings, start of all partitions and as shown on plans.

H. Brace stud framing system and make rigid.

I. Coordinate erection of studs with requirements of door and window frame supports and attachments.

J. Align stud web openings.

K. Coordinate installation of bucks, anchors, and blocking with electrical and mechanical work to be placed in or behind stud framing.

L. Blocking: Secure wood blocking to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and cabinetry.

M. Refer to Drawings for indication of partitions extending through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.

N. Coordinate placement of insulation in multiple stud spaces made inaccessible after stud framing erection.

3.03 INSTALLATION, GENERAL

A. Maximum Variation from True Position: 1/4 inch.

B. Maximum Variation of any Member from Plane: 1/8 inch.

C. Installation Standard: ASTM C 754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.

2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.anel systems: 1/180 of wall height.

3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.

4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

D. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

E. Install bracing at terminations in assemblies.

F. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

END OF SECTION

SECTION 092400 - STUCCO

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall furnish and install the stucco exterior finish of all wall and overhang surfaces where shown on the drawings and specified herein.

B. Stucco is a final architectural treatment prior to painting and therefore it shall provide a decorative, durable, consistent, even finish with no imperfections of the substrate telegraphing through the stucco.

1.2 REFERENCES

A. Except as modified by governing local codes and by this specification, conforms to provisions and recommendations of the following standards.

1. ASTM C 926-98.
2. Portland Cement Plaster Manual (Stucco) for reference.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit eight copies of manufacturer's specifications and installation instructions for each material required, including other data as may be required to show compliance with these specifications.

B. Sample: For final review of each texture, complete one wall area on job site 5 working days minimum before proceeding with the work.

1.4 DELIVERY, STORAGE AND HANDLING

A. Source of supply: Do not change brands or source of supply for materials during course of work.

B. Protection: Deliver materials except for sand and water in manufacturer's unopened containers fully identified with name, brand, type and grade. Protect stucco materials from contamination and dampness until used. Store in a dry ventilated space off the ground. Protect lime putty from sun exposure and prevent excessive evaporation when stored.

1.5 CODES

A. Comply with the requirements of the latest Florida Building Code (2020)

PART 2 – PRODUCTS

2.1 PRODUCTS

A. Aggregates:

1. Portland Cement stucco base aggregates shall be ASTM C 897 Specifications Aggregates for Job-Mixed Portland Cement-Based Plaster.

2. Portland Cement stucco finish shall be graded silica sand passing a 30-mesh screen.

B Fiber Reinforcement: Fiber reinforcement shall be fiberglass "fibermesh", or equal, 1/2-inch-long, free from grease, oil dirt and other impurities. Separate before use.

C. Metal Lath: Shall be FS-UU-B-790A grade D, style 2, metal lath (stucco) reinforcement with asphalt impregnated paperback.

D. Portland Cement: ASTM C 150 Type I or Type II.

E. Lime: Shall be hydrated, ASTM C 207, Type S.

F. Accessories: Corner beads, casing beads and expansion joints; Polyvinyl PVC.

G. Bonding Compounds:

1. Exterior Applications:
   a. Acryl 60 by Thoro.
   b. Bonsal 118 Primer by Bonsal
   c. STO Bonding Agent CR245 by STO

H. Bonding Admixtures:

1. Exterior Applications:
   a. Acryl 60 by Thoro.
   b. Bonsal 118 Admixture manufactured by Bonsal.
   c. STO Admixture CR245 by STO

2.2 MIXES

A. General:

1. All mixes are by volume unless otherwise specified. All mix proportions are suggestive only, variations to meet local conditions to achieve desired finish are permitted within limits specified in ASTM C 926-98.

2. Make lime putty from hydrated lime; machine-mix with bonding admixture to putty form; allow to stand at least 15 minutes before using.

3. Water shall be potable and free from deleterious materials which would impair the work and from a source approved by Architect.

B. Stucco: Install in three coats as follows:

1. Prep Coat at Concrete Surfaces only: mix bonding agent and Portland cement to create a slurry mixture. Do not add water.

2. Scratch and Brown Coats (2 coats)

   a. Low absorption bases
      i) 1-part Portland Cement.
      ii) ¾ to 1½ parts lime.
      iii) 2½ to 4 parts aggregate.
      iv) 1 lb. fiber per sack of cement (on metal lath).

   b. High absorption Base
      i) 1-part Portland Cement

ii) 3/4 to 2 parts lime
iii) 2 1/2 to 5 parts aggregate
iv) 1 lb. fiber per sack of cement

3. Finish Coat:

a. Finish coat shall bring total stucco application to full thickness (5/8" or thickness to match existing adjacent stucco) and provide a pattern as approved by the Architect. Finish texture shall be smooth to match existing adjacent stucco.

b. Horizontal reveals as shown on the plans shall be 1/8" deep and straight.

PART 3 – EXECUTION

3.1 EXAMINATION OF SUBSTRATES

A. Examine substrates and the conditions under which the stucco work is to be installed. Do not proceed until unsatisfactory conditions detrimental to the proper and timely completion of the work have been corrected.

B. Concrete Surfaces: Sand blast all concrete to receive stucco, clean off dust, loose particles, form oils and other foreign matter including previously applied bonding agent. Apply prep coat immediately prior to applying scratch coat.

3.2 INSTALLATION

A. General: Apply 3-coat work on all substrates indicated to receive Stucco on plan for total of 5/8 inch or thickness to match existing adjacent stucco. Apply finish coat with a reasonable uniform thickness over entire surface, with vertical surfaces flat, straight and plumb. Make interior angles square and make corners square but slightly rounded. Where casing beads do not occur at the juncture of stucco and hollow metal frames, cut a groove in the base coat and later in the finish coat to minimize the appearance of cracks at these joints.

B. Mixing:

1. Use mechanical mixers for mixing stucco only. Do not use caked or lumped material. Clean mechanical mixers, mixing boxes and tools after mixing each batch; keep free of stucco from previous mixes. Thoroughly mix stucco with proper amount of water until uniform in color and consistency. Tempering of stucco will not be permitted; discard stucco which has begun to stiffen. Provide waterproof protection under mixer.

2. Machine Applied Stucco: Determine proper consistency by slump test as follows: Take slump test samples from nozzle of stucco cone. Take samples as often as may be required or as directed by Architect. Maximum slump shall be 2 1/2 inches.

C. Application:

1. Application shall be by hand or machine. Limit machine application to base coats, except where machine texture finish is specified.

3.3 FIELD QUALITY CONTROL

A. Patching:

1. Work containing cracks, blisters, pits, checks, or discoloration will not be accepted. Remove such work including rejected work and replace with new. Patching of defective work permitted only after notification of Architect.

2. Perform cutting, patching, repairing and pointing-up operations neatly and thoroughly. Repair the cracks and indented surfaces by moistening the stucco and filling with new material, troweled or tamped flush with adjoining surfaces. Point-up and finish surfaces around fixtures, outlet boxes, piping, fittings, tile and other work installed more than 48 hours, cut existing stucco at an angle of approximately 45 degrees with the surface before installing new stucco.

3.4 CLEANING AND PROTECTION

A. Make provisions to minimize spattering of stucco on other work. Promptly clean windows and other surfaces which have been soiled.

B. Protect stucco from the weather, premature drying ASTM C 926-98 xi.4.2, dirt, dust, marring or other damage throughout the construction period so it will be without any indication of damage at time of acceptance by City.

END OF SECTION

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

A. RELATED DOCUMENTS:

B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Types of work include:

1. Gypsum drywall including screw-type metal support system.

2. Gypsum drywall applied to metal framing and furring.

3. Gypsum backing boards for application of other finishes.

4. Drywall finishing (joint tape-and-compound treatment).

1.3 QUALITY ASSURANCE:

A. Fire-Resistance Ratings: Where gypsum drywall systems with fire- resistance ratings are indicated, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories acceptable to authorities having jurisdiction.

1. Provide fire-resistance rated assemblies identical to those indicated by reference to design designations in UL "Fire Resistance Directory" or in listing of other testing and agencies acceptable to authorities having jurisdiction.

B. Single Source Responsibility: Obtain gypsum board products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's product specifications and installation instructions for each gypsum drywall component, including other data as may be required to show compliance with these specifications.

B. FGBC Submittals: Florida Green Building Coalition (FGBC) min. silver rating

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

1.6 PROJECT CONDITIONS:

A. Environmental Requirements, General: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.

B. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Metal Support Materials:

a. Allied Structural Industries.

b. Bostwich Steel Framing Co.

c. Gold Bond Building Products Div., National Gypsum Co.

d. Milcor Division; Inryco Inc.

e. United States Gypsum Co.

f. Or Approved Equal

2. Direct Suspension Systems:

a. Chicago Metallic Corp.

b. Donn Corporation.

c. United States Gypsum Co.

d. Or Approved Equal

3. Gypsum Board and Related Products:

a. American Gypsum Co.

b. Georgia-Pacific Corp.

c. Gold Bond Building Products Div., National Gypsum Co.

d. United States Gypsum Co.

e. Or Approved Equal

2.2 METAL SUPPORT MATERIALS:

A. Ceiling Support Materials and Systems:

B. General: Size ceiling support components to comply with ASTM C 754 unless otherwise indicated.

C. Main Runners: Steel channels with rust inhibitive paint finish, hot or cold-rolled.

D. Hanger Wire: ASTM A 641, soft, Class 1 galvanized.

E. Hanger Rods and Flats: Mild steel with zinc or equally rust inhibitive coating for rods and zinc or rust-inhibitive paint finish for flats.

F. Angle-Type Hangers: Not less than 7/8" x 7/8" x 16-gage galvanized steel formed angles, with bolted connections and 5/16" diameter bolts.

G. Hanger Anchorage Devices: Screws, clips, bolts, cast-in-place concrete inserts or other devices applicable to the indicated method of structural anchorage for ceiling hangers and whose suitability for use intended has been proven through standard construction practices or by certified test data. Size devices for 3x calculated load supported except size direct pull-out concrete inserts for 5x calculated loads.

H. Furring Members: ASTM C 645, 0.0179" min. thickness of base metal, hat shaped, for spans of less than 4 feet.

I. Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, C-shaped studs, for spans greater than 4 feet.

J. Furring Anchorages: 16-gage galvanized wire ties, manufacturer's standard wire-type clips, bolts, nails or screws as recommended by furring manufacturer and complying with C 754.

K. Direct Suspension Systems: Manufacturer's standard zinc-coated or painted steel system of furring runners, furring tees, and accessories designed for concealed support of gypsum drywall ceilings; of proper type for use intended.

L. Wall/Partition Support Materials:

1. Studs: ASTM C 645; 0.0312" min. thickness of base metal unless otherwise indicated.

a. Depth of Section: 3-5/8" and 6", except as otherwise indicated.

b. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

c. Refer to wall types and details for additional information

M. Fasteners for Furring Members: Type and size recommended by furring manufacturer for the substrate and application indicated.

2.3 GYPSUM BOARD:

A. Gypsum Wallboard: ASTM C 36, of types, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.

1. Type: Type X, unless otherwise indicated.

2. Type: Type X for fire-resistant rated assemblies and where indicted.

3. Edges: Tapered.

4. Thickness: 5/8", unless otherwise indicated.

B. Gypsum Backing Board for Multi-Layer Applications: ASTM C 442 or, where backing board is not available from manufacturer, gypsum wallboard, ASTM C 36, of type, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to- end joints.

1. Type: Type X, unless otherwise indicated.

2. Type: Type X for fire-resistance rated assemblies and where indicated.

3. Edges: Manufacturer's standard.

4. Thickness: 5/8", unless otherwise indicated.

C. Water-resistant Board: ASTM C 630, with tapered edges and of type and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.

1. Type: Moisture resistant 'Aquatuff', unless otherwise indicated.

2. Type: Type X for fire-resistant rated assemblies and where indicated.

3. Thickness: 5/8", unless otherwise indicated.

2.4 TRIM ACCESSORIES:

A. General: Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf-type edge trim-beads, and one-piece control joint beads.

1. Semi-Finishing Type: Manufacturer's standard trim units which are not to be finished with joint compound (non- beaded).

2. Plastic Edge Trim: Manufacturers standard rigid or semi- rigid PVC moldings of the semi-finished type, shaped to provide resilient contact of gypsum board edges with other work; friction-fit, or pressure-sensitive adhesive mounting.

B. H-Molding: Manufacturer's standard extruded aluminum H-molding of height required for board, designed for combination trim and control joint in exterior gypsum board ceiling/soffit work.

2.5 JOINT TREATMENT MATERIALS:

A. General: ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.

B. Joint Tape: Paper reinforcing tape.

C. Joint Compound: On interior work provide chemical-hardening-type for bedding and filling, ready-mixed vinyl-type or vinyl-type powder type for topping.

D. Water-resistant Joint Compound: Special water-resistant type for treatment of joints, fastener heads and cut edges of water- resistant backing board.

1. Product: Subject to compliance with requirements, provide Sheetrock Brand W/R Compound; United States Gypsum Co.

2.6 MISCELLANEOUS MATERIALS:

A. General: Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.

B. Laminating Adhesive: Special adhesive or joint compound specifically recommended for laminating gypsum boards.

C. Gypsum Board Screws: Comply with ASTM C 646.

D. Sound Attenuation Blankets: FS HH-I-521, Type I; semi-rigid mineral fiber blanket without membrane, Class 25 flame-spread, thicknesses as indicated.

E. Water-resistant Adhesive: Type I organic adhesive for ceramic tile complying with ANSI A136.1.

PART 3 - EXECUTION

3.1 PREPARATION FOR METAL SUPPORT SYSTEMS:

A. Ceiling Anchorages: Coordinate work with structural ceiling work to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling hangers.

1. Furnish concrete inserts, steel deck hanger clips and similar devices to other trades for installation well in advance of time needed for coordination with other work.

3.2 INSTALLATION OF METAL SUPPORT SYSTEMS:

A. General:

1. Metal Support Installation Standard: Comply with ASTM C 754.

2. Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.

3. Nail or screw furring members to wood framing as indicated.

4. Ceiling Support Suspension Systems: Secure hangers to structural support by connecting directly to structure where possible, otherwise connect to inserts, clips or other anchorage devices or fasteners as indicated.

5. Space main runners 4'-0" o.c. and space hangers 4'-0" o.c. along runners, except as otherwise indicated.

6. Level main runners to a tolerance of 1/4" in 12'-0", measured both lengthwise on each runner and transversely between parallel runners.

7. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

8. Direct-hung Metal Support System: Attach perimeter wall track or angle wherever support system meets vertical surfaces.

9. Mechanically join support members to each other and butt-cut to fit into wall track.

10. Space furring member 16" o.c., except as otherwise indicated.

11. Install auxiliary framing at termination of drywall work, and at openings for light fixtures and similar work, as required for support of both the drywall construction and other work indicated for support thereon.

12. Wall/Partition Support Systems: Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar work to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co.

13. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.

14. Install runner tracks at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.

15. Extend partition stud system through acoustical ceilings and elsewhere as indicated to the structural support and substrate above the ceiling.

16. Terminate partition stud system at ceilings, except where indicated to be extended to structural support or substrate above.

17. Space studs 16" o.c., unless otherwise indicated.

18. Frame door openings to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for jack studs) at head and secure to jamb studs.

    a. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above, unless otherwise indicated.

19. Frame openings other than door openings to comply with details indicated or if not indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

20. Space wall furring members 16" o.c., unless otherwise indicated.

3.3 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS:

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA 216.

B. Install sound attenuation blankets as indicated, prior to gypsum board unless readily installed after board has been installed.

C. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate courses of board.

D. Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 1'-0".

E. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.

F. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.

G. Locate either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

H. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

I. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.

J. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are braced internally.

1. Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area and may be limited to not less than 75% of full coverage.

K. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant.

L. Floating Construction: Where feasible, including where recommended by manufacturer, install gypsum board over wood framing, with "floating" internal corner construction.

M. Where sound-rated drywall work is indicated (STC rating), including double-layer work and work on resilient furring, seal the work at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of beads and close off sound-flanking paths around or through the work, including sealing of partitions above acoustical ceilings.

N. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

3.4 METHODS OF GYPSUM DRYWALL APPLICATION:

A. Single-Layer Application: Install gypsum wallboard.

1. On ceilings apply gypsum board prior to wall/partition board application to the greatest extent possible.

2. On partitions/walls apply gypsum board vertically (parallel), unless otherwise indicated, and provide sheet lengths which will minimize end joints.

3. On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular); use maximum length sheets possible to minimize end joints.

4. On Z-furring members apply gypsum board vertically (parallel) with no end joints. Locate edge joints over furring members.

B. Wall Tile Base: Where drywall is base for thin-set ceramic tile and similar rigid applied wall finishes, install gypsum backing board.

1. At showers, tubs and similar "wet" areas, install water- resistant backing board. Apply with uncut long edge at bottom of work, and space 1/4" above fixture lips. Seal ends, cut-edges and penetrations of each piece with water-resistant adhesive or, where recommended by backing board manufacturer, with water-resistant joint compound.

C. Double-Layer Application: Install gypsum backing board for base layer and exposed gypsum board for face layer.

1. On partitions/walls apply base layer and face layers vertically (parallel) with joints of base layer over supports and face layer joints offset at least 10" with base layer joints.

D. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:

1. Fasten with screws.

2. Fasten to wood supports with single nailing.

E. Double-Layer Fastening Methods: Apply base layer of gypsum board and face layer to base layer as follows:

1. Fasten both base layers and face layers separately to supports with screws.

3.5 INSTALLATION OF DRYWALL TRIM ACCESSORIES:

A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

B. Install metal corner beads at external corners of drywall work.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

D. Install plastic edge trim where indicated on wall panels at juncture with ceilings.

E. Install metal control joint (beaded-type) where indicated.

3.6 FINISHING OF DRYWALL:

A. General: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fasteners heads, surface defects and elsewhere as required to prepare work for decoration. Pre-fill open joints and rounded or beveled edges, if any, using type of compound recommended by manufacturer.

1. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

2. Apply joint compound in 3 coats (not including pre-fill of openings in base), and sand between last 2 coats and after last coat.

B. Water-resistant Gypsum Backing Board Base for Ceramic Tile: Comply with recommendations of gypsum backing board manufacturer for treatment of joints behind ceramic tile.

C. Regular Gypsum Board Base for Ceramic Tile: In areas to be tiled using organic adhesive, tape joints and apply 4" wide coat of joint compound.

D. Partial Finishing: Omit third coat (if specified) and sanding on concealed drywall work which is indicated for drywall finishing or which requires finishing to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

E. Refer to sections on painting, coatings and wall-coverings in Division 9 for decorative finishes to be applied to drywall work.

3.7 PROTECTION OF WORK:

A. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall work being without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 095113 – ACOUSTICAL CEILING

CALLA

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes

1. Acoustical ceiling panels
2. Exposed grid suspension system
3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings
4. Perimeter Trim

B. Related Sections

1. Section 09 29 00 - Gypsum Board
2. Section 01 81 13 - Sustainable Design and Construction Requirements
3. Division 23 - HVAC Air Distribution
4. Division 26 - Electrical

C. ALTERNATES

1. Prior Approval: Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products that have not been pre-approved by the architect and included in the Addenda, the originally specified products shall be provided without additional compensation.
2. Submittals that do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers; Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
9. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
10. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
11. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
12. ASTM E 1264 Classification for Acoustical Ceiling Products

B. International Building Code

C. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality

D. NFPA 70 National Electrical Code

E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

F. International Code Council-Evaluation Services Report - Seismic Engineer Report

1. ESR 1308 - Armstrong Suspension Systems

G. International Association of Plumbing and Mechanical Officials - Seismic Engineer Report

1. 0244 - Armstrong Single Span Suspension System

1.4 SYSTEM DESCRIPTION

A. Continuous/Wall-to-wall

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

B. Samples: Minimum 6-inch x 6-inch samples of specified acoustical panel; 8-inch-long samples of exposed wall molding and suspension system, including main runner and 4-foot cross tees.

C. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with or supported by the ceilings.

D. Acoustical Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification, such as Underwriter’s Laboratory (UL), of NRC, CAC, and AC.

1. If the material supplied by the acoustical subcontractor does not have an independent laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must

be removed, disposed of, and replaced with complying product at the expense of the Contractor performing the work.

1.6 SUSTAINABLE MATERIALS

A. Transparency: Manufacturers will be given preference when they provide documentation to support sustainable requirements for the following: Material ingredient transparency, Removal of Red List Ingredients per LBCV3, Life Cycle impact information, Low-Emitting Materials, and Clean Air performance.

1. Health Product Declaration (HPD). The end use product has a published, complete Health Product Declaration with disclosure at a minimum of 1000ppm of known hazards in compliance with the Health Product Declaration Open Standard.

2. Declare Label. The end use product has a published Declare label by the International Living Future Institute with disclosure of 100 ppm with a designation of Red List Free or Compliant (less than 1% proprietary ingredients).

3. Low Emitting products with VOC emissions data. Preference will be given to manufacturers that can provide emissions data showing their products meet any of the following: CDPH/EHLB/Standard Method v1.2-2017; Indoor Air Quality Certified to SCS-105 v4.2-2023

4. Life cycle analysis. Products that have communicated lifecycle data through Environmental Product Declarations (EPDs) will be preferred.

5. Biobased products derived from plants and other renewable materials will be given preference. Provide USDA Certified Biobased Product certification.

6. End of Life Programs/Recycling: Where applicable, manufacturers that provide the option for recycling of their products into new products at end-of-life through take-back programs will be preferred.

1.7 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer to ensure fit and function.

B. Installer Qualifications: Company specializing in performing specified work type, a minimum of three years of documented experience, and approved by the manufacturer.

C. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

D. Surface Burning Characteristics: Tested per ASTM E 84 and complying with ASTM E 1264 Classification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.9 PROJECT CONDITIONS

A. Space Enclosure:

1. HumiGuard Plus Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Products with HumiGuard Plus performance and hot dipped galvanized steel, aluminum or stainless-steel suspension systems can be installed up to 120°F (49°C) and in spaces before the building is enclosed, where HVAC systems are cycled or not operating. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact with the ceiling.

1.9.1 ALTERNATE CONSTRUCTION WASTE DISPOSAL

A. Ceiling material being reclaimed must be kept dry and free from debris.

B. Before disposing of ceilings, contact the Armstrong Recycling Center at 877-276-7876, select option #1 then #8 to review with a consultant the condition and location of building where the ceilings will be removed. The consultant will verify the condition of the material and that it meets the Armstrong requirements for recycling. The Armstrong consultant will help facilitate the process to recycle the ceiling.

1.10 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

1. Acoustical Panels with HumiGuard® Max and HumiGuard® Plus performance: sagging and warping

2. Acoustical panels with BioBlock® performance: growth of mold and mildew

3. Grid System: rusting and manufacturer's defects

B. Warranty Period:

1. Ceiling System: Thirty (30) years from date of substantial completion

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.11 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.

2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 – PRODUCTS

Attention Design Professional: Please edit Part 2 based on your project needs. Select product attributes and acceptable product item (s) that fit with the requirements of your project. Delete all items from the specification that do not relate to your project needs. Please refer to the Armstrong website for additional ceilings, suspension systems, perimeter trim options, and accessories. The related guide specifications for each of these items are available on the Armstrong website.

2.1.1 MANUFACTURERS

A. Ceiling Panels:

1. Armstrong World Industries, Inc.

B. Suspension Systems:

1. Armstrong World Industries, Inc.

2.2 ACOUSTICAL CEILING UNITS

A. Acoustical Panel Ceilings

1. Surface Texture: Smooth Texture
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24 in x 24 in
5. Edge Profile: Square Lay-in
6. Noise Reduction Coefficient (NRC) ASTM C 423 Classified w/ UL label on product carton: 0.85
7. Ceiling Attenuation Class (CAC): ASTM E1414/E1414M; Classified with UL label on product carton: 35
8. Articulation Class (AC): ASTM E 1111; Classified with UL label on product carton: 170
9. Flame Spread: ASTM E 1264; Class A
10. Light Reflectance (LR) White Panel: ASTM E 1477; 0.85
11. Dimensional Stability: HumiGuard Plus
12. Recycle Content: Up to 76% total recycled content. (Total recycled content: pre-consumer, post-consumer and post-industrial)
13. Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
14. Life Cycle Assessment: Third Party Certified Environmental Product Declaration (EPD)
15. Indoor Air Quality Certified to SCS-105 v4.2-2023
16. USDA Certified Biobased Product
17. Basis of Design: Calla, item number _2824 (WH)_, as manufactured by Armstrong World Industries, Inc.
18. Substitutions: Refer to Alternates in Part 1.

2.3 METAL SUSPENSION SYSTEMS

A. Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.

1. Structural Classification: ASTM C 635 Intermediate or Heavy Duty.
2. Color: White or match the actual color of the selected ceiling tile, unless noted otherwise.
3. Sustainability: Environmental Product Declaration (EPD), Health Product Declaration (HPD)
4. Basis of Design (select one to work with specified ceiling):
    i. Prelude XL 15/16” Exposed Tee as manufactured by Armstrong World Industries, Inc.

5. Substitutions: Refer to Alternates in Part 1.

B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.

D. Edge Moldings as manufactured by Armstrong World Industries, Inc.

E. AXIOM Trim & Transitions as manufactured by Armstrong World Industries, Inc. www.armstrongceilings.com/axiom

F. Accessories as manufactured by Armstrong World Industries, Inc.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max Ceilings)

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

A. Follow manufacturer installation instructions.

B. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

C. Suspend main beam from overhead construction with hanger wires spaced 4 feet on center along the length of the main runner. Install hanger wires plumb and straight.

D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

E. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

F. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.4 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

END OF SECTION

SECTION 095113 – ACOUSTICAL CEILING

LYRA

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes

1. Acoustical ceiling panels
2. Exposed grid suspension system
3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings
4. Perimeter Trim

B. Related Sections

1. Section 09 29 00 - Gypsum Board
2. Section 01 81 13 - Sustainable Design Construction Requirements
3. Division 23 - HVAC Air Distribution
4. Division 26 - Electrical

C. ALTERNATES

1. Prior Approval: Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products that have not been pre-approved by the architect and included in the Addenda, the originally specified products shall be provided without additional compensation.
2. Submittals that do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers; Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
9. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
10. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
11. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
12. ASTM E 1264 Classification for Acoustical Ceiling Products

B. International Building Code

C. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality

D. NFPA 70 National Electrical Code

E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

F. International Code Council-Evaluation Services Report - Seismic Engineer Report

1. ESR 1308 - Armstrong Suspension Systems

G. International Association of Plumbing and Mechanical Officials - Seismic Engineer Report

1. 0244 - Armstrong Single Span Suspension System

1.4 SYSTEM DESCRIPTION

A. Continuous/Wall-to-wall

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

B. Samples: Minimum 6-inch x 6-inch samples of specified acoustical panel; 8-inch-long samples of exposed wall molding and suspension system, including main runner and 4-foot cross tees.

C. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with or supported by the ceilings.

D. Acoustical Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification, such as Underwriter’s Laboratory (UL), of NRC, CAC, and AC.

1. If the material supplied by the acoustical subcontractor does not have an independent laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of, and replaced with complying product at the expense of the Contractor performing the work.

1.6 SUSTAINABLE MATERIALS

A. Transparency: Manufacturers will be given preference when they provide documentation to support sustainable requirements for the following: Material ingredient transparency, Removal of Red List Ingredients per LBCV3, Life Cycle impact information, Low-Emitting Materials, and Clean Air performance.

1. Health Product Declaration (HPD). The end use product has a published, complete Health Product Declaration with disclosure at a minimum of 1000ppm of known hazards in compliance with the Health Product Declaration Open Standard.

2. Declare Label. The end use product has a published Declare label by the International Living Future Institute with disclosure of 100 ppm with a designation of Red List Free or Compliant (less than 1% proprietary ingredients).

3. Low Emitting products with VOC emissions data. Preference will be given to manufacturers that can provide emissions data showing their products meet any of the following: CDPH/EHLB/Standard Method v1.2-2017; Indoor Air Quality Certified to SCS-105 v4.2-2023

4. Life cycle analysis. Products that have communicated lifecycle data through Environmental Product Declarations (EPDs) will be preferred.

5. Biobased products derived from plants and other renewable materials will be given preference. Provide USDA Certified Biobased Product certification.

6. End of Life Programs/Recycling: Where applicable, manufacturers that provide the option for recycling of their products into new products at end-of-life through take-back programs will be preferred.

1.7 QUALITY ASSURANCE

1. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer to ensure fit and function.

2. Installer Qualifications: Company specializing in performing specified work type, a minimum of three years of documented experience, and approved by the manufacturer.

3. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

4. Surface Burning Characteristics: Tested per ASTM E 84 and complying with ASTM E 1264 Classification.

1.8 DELIVERY, STORAGE, AND HANDLING

1. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

2. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

3. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.9 PROJECT CONDITIONS

1. Space Enclosure:

a. HumiGuard Plus Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Products with HumiGuard Plus performance and hot dipped galvanized steel, aluminum or stainless-steel suspension systems can be installed up to 120°F (49°C) and in spaces before the building is enclosed, where HVAC systems are cycled or not

operating. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact with the ceiling.

1.10 ALTERNATE CONSTRUCTION WASTE DISPOSAL

1. Ceiling material being reclaimed must be kept dry and free from debris.
2. Before disposing of ceilings, contact the Armstrong Recycling Center at 877-276-7876, select option #1 then #8 to review with a consultant the condition and location of building where the ceilings will be removed. The consultant will verify the condition of the material and that it meets the Armstrong requirements for recycling. The Armstrong consultant will help facilitate the process to recycle the ceiling.

1.11 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
   1. Acoustical Panels with HumiGuard® Max and HumiGuard® Plus performance: sagging and warping
   2. Acoustical panels with BioBlock® performance: growth of mold and mildew
   3. Grid System: rusting and manufacturer's defects

B. Warranty Period:
   1. Ceiling System: Thirty (30) years from date of substantial completion

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.12 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
   1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.
   2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

1. Ceiling Panels:
   a. Armstrong World Industries, Inc.
2. Suspension Systems:

a. Armstrong World Industries, Inc.

2.2 ACOUSTICAL CEILING UNITS

1. Acoustical Panel Ceilings
   a. Surface Texture: Smooth Texture
   b. Composition: Mineral Fiber

c. Color: White

d. Size: 24 in x 24 in

e. Edge Profile: Square Tegular

f. Noise Reduction Coefficient (NRC) ASTM C 423 Classified w/ UL label on product carton: 0.85

g. Ceiling Attenuation Class (CAC): ASTM E1414/E1414M; Classified with UL label on product carton: 35

h. Articulation Class (AC): ASTM E 1111; Classified with UL label on product carton: 170

i. Flame Spread: ASTM E 1264; Class A

j. Light Reflectance (LR) White Panel: ASTM E 1477; 0.85

k. Dimensional Stability: HumiGuard Plus

l. Recycle Content: Up to 76% total recycled content. (Total recycled content: pre-consumer, post-consumer and post-industrial)

m. Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label

n. Life Cycle Assessment: Third Party Certified Environmental Product Declaration (EPD)

o. Indoor Air Quality Certified to SCS-105 v4.2-2023

p. USDA Certified Biobased Product

q. Basis of Design: **Calla, item number __8731PB_,** as manufactured by Armstrong World Industries, Inc.

r. Substitutions: Refer to Alternates in Part 1.

2.3 METAL SUSPENSION SYSTEMS

A. Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.

1. Structural Classification: ASTM C 635 Intermediate or Heavy Duty.

2. Color: White or match the actual color of the selected ceiling tile, unless noted otherwise.

3. Sustainability: Environmental Product Declaration (EPD), Health Product Declaration (HPD)

4. Basis of Design (select one to work with specified ceiling):

   a. Prelude XL 15/16” Exposed Tee as manufactured by Armstrong World Industries, Inc.

5. Substitutions: Refer to Alternates in Part 1.

B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.

D. Edge Moldings as manufactured by Armstrong World Industries, Inc.

E. AXIOM Trim & Transitions as manufactured by Armstrong World Industries, Inc. www.armstrongceilings.com/axiom

F. Accessories as manufactured by Armstrong World Industries, Inc.

END OF SECTION

SECTION 095190- RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid Vinyl floor tile (Luxury Vinyl Floor Tile).

2. Resilient base.

1.3 SUBMITTALS

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

1. Product Data: For adhesives including printed statement of VOC content.

B. LEED Submittals: Florida Green Building Coalition (min. silver rating)

C. General Contractor shall submit material selection board with trim, patterns, selected colors, etc.

D. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

E. Samples for Initial Selection: For each type of floor tile indicated.

F. Qualification Data: For qualified Installer.

G. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.

2. During installation.

3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

2. Resilient Base: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 SOLID VINYL FLOOR TILE

A. Products: Subject to compliance with requirements, provide one of the following:
1. Amtico Studio (The), Amtico International Inc.
2. Armstrong World Industries, Inc.
3. Burke Mercer Flooring Products, Division of Burke Industries Inc.
4. Gerflor, Architectural Floor Systems, Inc.
5. Johnsonite
6. Tarkett, Inc.
7. TOLI International

B. Tile Standard: ASTM F 1700.

1. Class: As indicated by product designations
2. Type: Type A, smooth surface
3. Slip resistance: ADA Compliant

C. Thickness: Minimum [0.120 inch (3.0 mm)]

D. Size: 12 by 12 inches (305 by 305 mm)

E. Seaming Method: Standard

F. Colors and Patterns: As selected by Design Team from full range of industry colors.

2.2 RESILIENT BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allstate Rubber Corp.; Stoler Industries.

2. Armstrong World Industries, Inc.

3. Burke Mercer Flooring Products; Division of Burke Industries, Inc.

4. Roppe Corporation, USA

5. Or Approved equal

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TS (rubber, vulcanized thermoset).

2. Manufacturing Method: Group I (solid, homogeneous).

3. Style: Cove (base with toe).

C. Minimum Thickness: 0.125 inch.

D. Height: 6 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Finish: Satin.

2.3 FLOOR TILE INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. VCT Adhesives: Not more than 50 g/L.

C. Floor Polish: Provide protective Urethane floor finish compatible with floor tile.

2.4 BASE INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: Not more than 50 g/L.

b. Rubber Floor Adhesives: Not more than 60 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, non staining marking device.

G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.

3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply two coats.

E. Cover floor tile until Substantial Completion.

END OF SECTION

SECTION 096460 – WOOD ATHLETIC & SPORTS FLOORING

GYMNASIUM APPLICATION

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope

1. The complete installation of Robbins Bio-Channel Star floor system by Robbins, Inc. of Cincinnati, Ohio.

B. Related work specified under other sections. (A cross-reference should be incorporated in these sections.)

1. Concrete and Concrete Finishing - Section 03.
   a. Concrete Slab Depression: 2 1/2" (54mm) using 25/32" (20mm) flooring.
   b. Surface Finish: steel troweled and finished smooth.
   c. Concrete Tolerance: +/- 1/8" (3mm) in radius of 10' (3m). High spots shall be ground level and low spots shall be filled in with approved leveling compound by the general contractor to meet the tolerance above. Floor Flatness and Floor Levelness (FF and FL) numbers are not recognized.
   d. Compressive Strength: Concrete shall be a minimum of 3,000 psi (21 MPa) and a maximum of 4000 psi (28MPa) compressive strength after 28 days. Concrete shall be free of washed river gravel, pea gravel, flint or hardener additives. No lightweight concrete.
2. Membrane Waterproofing and Damp proofing - Section 07.
   a. Concrete subfloors on or below grade shall be adequately waterproofed beneath the slab and at the perimeter walls and on the earth side of below grade walls by general contractor using suitable type membrane.
   b. Sand-Poly-Sand slab construction is not an acceptable construction.
3. Thresholds - Section 08.
4. Game Standard Inserts - Section 11

1.02 REFERENCES

A. MFMA - Maple Flooring Manufacturers Association
B. MFMA PUR – Performance Uniformity Requirements
C. DIN 108032 (part 2) 2001 - Performance Test
D. DIN 108032 (part 2) 1991 - Performance Test
E. ASTM F2772 - Athletic Performance Properties of Indoor Sports Floor Systems
F. EN 14904 – European Committee for Standardization – Surfaces for Sports areas
G. ASTM F2772 - Athletic Performance Properties of Indoor Sports Floor Systems
H. FIBA – International Basketball Federation
I. FSC – Forest Stewardship Council
J. FBC – Florida Building Code 2020

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications
   1. Basis of design shall be Bio-Channel Star floor system as provided by Robbins Sports Surfaces, www.robbinsfloor.com, (800-543-1913)
   2. The manufacturer shall be an established firm experienced in products specified in this section and have been in business a minimum of ten (10) years; Robbins, Inc. or an approved equal.
   3. Manufacturer shall be a member in good standing of the Maple Flooring Manufacturers Association (MFMA).
   4. Materials other than those listed must be approved 10 days prior by written addendum. Materials from non-approved manufacturers will not be accepted.

B. Floor Contractor/Installer Qualifications and Certifications
   1. The flooring contractor shall be a Robbins Accredited Installation Company with MFMA Accredited Installer(s) on-site for the duration of the wood floor installation; or, a contractor approved by Robbins Sports Surfaces.
   2. Flooring contractor shall submit a list of at least three completed projects of similar magnitude and complexity completed under current corporate identity.

C. Floor System Performance Requirements
   1. Bio-Channel Star meets or exceeds criteria of the following performance criteria:
      a. MFMA PUR
      b. DIN 18032 Part2 2001
      c. DIN 18032 Part2 1991
      d. ASTM F2772 Sport Floor Standards
      e. FIBA International Standards
      f. EN 14904 Standards
   2. Independent testing report showing the system passing all criteria shall be provided as part of the bid qualification process and submittal process
   3. Surface Appearance (available option)
      a. Expansion spaces will not exceed 1/64” (0.4mm) at time of installation and will be spread evenly across the floor with each row of flooring.
      b. Expansion spacing will be installed to allow for normal expected increases in Equilibrium Wood Moisture Content (EMC).
   4. The wood flooring shall be MFMA-FJ maple.
   5. Maple Flooring shall been tested in accordance under California Department of Public Health/EHLB/Standard Method Version 1.2, 2017 and been found to be in compliance with the standard.
   6. Closed cell foam is not accepted as a resilient pad.
   7. Resilient Pad must be laid in a continuous manner.
   8. The use of power-actuated or pneumatic anchoring systems is not allowed. The floor system must be anchored using the drilled and pinned method.
   9. Metal Channel anchorage shall be provided by 16 gauge (1.5mm) steel sections with subfloor anchor pockets dimensioned to allow a minimum of 1” (25mm) lateral movement.

10. Steel anchor channels shall be of double flange design to capture both side edges of subfloor anchor pocket.
11. Subfloor and metal channel design shall be constructed in a fashion to prevent the over
anchorage of the flooring system. Special anchorage tools are not acceptable.

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1.04 SUBMITTALS

A. Specification
1. Submit Robbins Bio-Channel Star specification sheet.

B. Drawing
1. Submit Robbins Bio-Channel Star drawings as required.

C. Sample
1. Submit one (1) sample of Bio-Channel Star if requested by architect

D. Concrete Guidelines
1. Submit Robbins Technical Services "Concrete Guide Specification" for further information regarding conditions and requirements of concrete prior to installation.

E. Maintenance Guidelines
1. Submit copy of Maintenance Instructions.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials
1. Materials shall not be delivered, stored, or installed until all masonry, painting, plastering tilework, marble and terrazzo work is complete, and all overhead mechanical work, lighting, backstops, scoreboards are installed. Room temperature of 55-80 degrees Fahrenheit (13 to 27 degrees Celsius) and relative humidity of 35-50 % are to be maintained. In- Slab Relative Humidity shall be 85% or less using ASTM F 2170 In-Slab Relative Humidity test. Ideal installation/storage conditions are the same as those that will prevail when building is occupied.
2. Materials shall not be stored at the installation location if the In-Slab relative humidity level for the concrete slab is above 85% using ASTM F 2170 In-Slab Relative Humidity test.

1.06 JOB CONDITIONS-SEQUENCY

A. Do not install floor system until concrete has been cured 60 days and the requirements in paragraph 1.05 A are obtained.

B. General Contractor is responsible to ensure slab is clean and free of all dirt and debris prior to floor installation beginning.

C. Permanent heat, light and ventilation shall be installed and operating during and after installation. Maintain a temperature range of 55 to 80 degrees Fahrenheit (13 to 27 degrees Celsius) and a relative humidity range of 35 to 50%. Consult MFMA guidelines for further information.

D. After floors are finished, area to be kept locked by general contractor to allow curing time for the finish. If after required curing time general contractor or City requires use of gym, he shall protect the floor by covering with non-fibered kraft paper or red rosin paper with taped joints, until acceptance by City (or City's agent) of complete gymnasium floor.

1.07 WARRANTY

A. Guarantee shall not cover damage caused in whole or in part by casualty, ordinary wear and tear, abuse, use for which material is not designed, faulty construction of the building, settlement of the building walls, failure of the other contractors to adhere to specifications, separation of the concrete slab and excessive dryness or excessive moisture from humidity, spillage, migration through the slab or wall, or any other source.

B. Robbins, Inc. hereby warrants the Bio-Channel Star material to be free from manufacturing defects for a period of 1 year. This warranty is in lieu of all other warranties, expressed or implied including but not limited to any warranty of merchantability or fitness for a particular purpose, and of any other obligations on the part of Robbins. In the event of breach of any warranty, the liability of Robbins shall be limited to repairing or replacing Bio-Channel Star material and system components supplied by Robbins and proven to be defective in manufacture, and shall not include any other damages, either direct or consequential.

PART 2 – PRODUCTS

2.01 MATERIAL

A. Vapor Barrier
   1. 15-mil polyethylene.

B. Subfloor
   1. 9/16" Zero/G™ shock pad.
   2. Bio-Channel Star Subfloor panels that have been factory prepared to accept anchor channel.
   3. Metal Anchor Channels.

C. Maple Flooring Manufacturers Association (MFMA) Wood Flooring:
   1. 25/32" (20mm) thick x 2 ½" (63mm) facewidth . Flooring as manufactured by Robbins and graded in accordance with MFMA-FJ rules.
   2. Grade: 2nd and Better for main court with 3rd Grade surround

D. Fasteners
   1. Flooring – 1-¾" (45mm) barbed cleats or staples.
   2. Subfloor – 1-5/8" to 1-¾" (40mm) subflooring nails or staples.
   3. Channel anchors - 1-1/2" (38mm) long steel Powers SPIKE® anchors or Tapcons

E. Finishing materials
   1. MFMA approved water based sealer.
   2. MFMA approved water based finish.

F. Gamelines
   1. Gameline paint(s) shall be recommended by the finishing materials manufacturer, and must be compatible with the finish.

G. Perimeter
   1. 3" x 4" ventilating type. (Specify black or brown)

PART 3-EXECUTION

3.01 INSPECTION

A. Inspect concrete slab for proper tolerance and dryness, and report any discrepancies to the general contractor and architect in writing. Slab will be level to within 1/8" (3mm) in a 10' (3m). Moisture content of the concrete slab shall not exceed 85% using ASTM F 2170 In-Slab Relative Humidity test.

B. All work required to put the concrete subfloors in acceptable condition shall be the responsibility of the general contractor.

C. Subfloor shall be broom cleaned by general contractor.

D. Installer shall document all working conditions provided in General Specifications prior to commencement of installation.

3.02 INSTALLATION

A. VAPOR BARRIER

1. Install polyethylene with joints lapped a minimum of 6" (150mm) and turned up 4" (100mm) at the walls.

B. SUBFLOOR

1. Install Robbins shock absorbing pad per manufacturer's recommendations over 6 mil poly.
2. Following manufacturer's guidelines, place Bio-Channel Star subfloor assembly in end-to-end manner, staggering end joints in adjacent rows. Allow for a ¼" (6mm) gap between panels. Panels shall be placed on a 45 degree angle to the direction of the maple flooring. Provide 1-½" to 2" (40 to 50mm) expansion void at the perimeter and all vertical obstructions.
3. Install solid blocking at doorways, under bleachers in the stacked position, and below portable goals.
4. Install Bleacher Blocking per manufacturer's recommendations.
5. Place metal anchor channel in each factory-prepared location in the panel.
6. Anchor each anchor channel in the center pre-routed hole only, unless trimming at wall or vertical obstruction requires relocation in adjacent location to anchor.

C. FLOORING

1. Machine nail maple finish flooring 10" to 12" (150mm to 200mm) O.C. with end joints properly driven up and proper spacing provided for humidity conditions in specific regions. Consult your local Robbins Accredited Installation Company "Certified" contractor. Provide 2" (50mm) expansion voids at the perimeter and at all vertical obstructions. Expansion rows will be evenly distributed with each row of flooring, with each space not exceeding 1/64" (0.4mm).

3.03 FINISHING

A. SANDING

1. Sand per manufacturer's recommendations.
2. After sanding, buff entire floor using 100 grit screen or equal grit sandpaper, with a heavy-duty buffing machine.
3. Inspect entire area of floor to insure the floor presents a smooth surface without drum stop marks, gouges, streaks or shiners.

4. Vacuum and/or tack floor before first coat of seal.

B. FINISHING
   1. Floor should be clean and completely free of dirt and sanding dust.
   2. Apply specified combination of seal, gameline paint, and finish in accordance with manufacturer's instructions.
   3. Buff and vacuum and/or tack between each coat after it dries.
   4. Apply game lines accurately after the buffing and vacuuming the coated surfaces. Game lines shall be painted between seal coats and finish coats. Layout in accordance with drawings. For game lines, use current rules of association having jurisdiction. Lines shall be straight with sharp edges in colors selected by architect.

3.04 WALL BASE INSTALLATION

A. Install vent cove base anchored to walls with base cement or screws. Use pre-molded outside corners and neatly mitered inside corner.

3.05 CLEANING

A. Clean up all unused materials and debris and remove it from the premises.

3.06 MAINTENANCE

A. Upon completion of floor installation, the Citys, attendants or individuals in charge are responsible for the upkeep of the building and are to see that the care and maintenance instructions of the MFMA and Robbins are followed.

3.07 MANUFACTURER

Robbins Floors

Contact your Regional Sales Manager (1-800-543-1913) or the local Authorized Dealer for more information.

3.08 SUBSTITUTIONS

Or approved equal with matching quantities, finishes, accessories & warranties

END OF SECTION

SECTION 096519 - RESILIENT VINYL FLOORING (LVT)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Resilient Luxury Vinyl Tile Flooring

1.3 SUBMITTALS

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

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.

D. Product Schedule: For resilient products. Use same designations indicated on Drawings**.**

1.4 QUALITY ASSURANCE

A. Installation Qualification: Contractors for floor covering installation should be experienced in managing commercial flooring projects and provide professional installers, qualified to install the various flooring materials specified. An installer is “qualified” if trained, or a certified by Tarkett or a certified INSTALL (International Standards & Training Alliance) resilient floor covering installer.

B. Mockups: Provide resilient products with mockups specified in other Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Tarkett, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.6 PROJECT CONDITIONS

A. Install resilient products after other finishing operations, including painting, have been completed.

B. Maintain ambient temperatures within range recommended by Tarkett, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
1. 48 hours before installation.

2. During installation.
3. 48 hours after installation.

C. Maintain the ambient relative humidity between 40% and 60% during installation.

D. Until Substantial Completion, maintain ambient temperatures within range recommended by Tarkett, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

PART 2 - PRODUCTS

2.01 RESILIENT SHEET FLOORING

A. Manufacturer: Tarkett North America
Tarkett North America
30000 Aurora Rd.
Solon, OH 44139
Web: www.tarkettna.com
Phone:800-899-8916

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.03 LUXURY VINYL TILE

A. Basis-of-Design Product: Subject to compliance with requirements, provide Tarkett; Contour Collection or approved equal.

B. Tile Standard: ASTM F 1700.

C. Wearing Surface: Embossed.

D. Edge Treatment: Square

E. Thickness/Wearlayer: 0.120 inch (3.05 mm).

F. Colors and Patterns: As selected by Architect from full range of industry colors.

G. Sizes:

1. Refer to manufacturer’s specifications.

H. Test data:
1. Surface Treatment: TechTonic
2. Wear layer: 0.032 inches (0.8 mm)
3. Size, Squareness, ASTM F2055: Passes
4. Flexibilty, ASTM F137: Passes
5. Chemical Resistance, ASTM E925: Passes

6. Static Load Limit, ASTM F970: 250 psi, ≤ 0.005 inches
7. Resistance to Heat, ASTM F1514: $\Delta E \leq 8$
8. Resistance to Light, ASTM F1515: $\Delta E \leq 8$
9. Residual Indentation, ASTM F1914: Passes
10. Static Coefficient of Friction (SCOF), ASTM D2047: ≥ 0.5 SCOF
11. Dimensional Stability, ASTM F2199: Passes
12. Flamability, ASTM E648 Critical Radiant Flux: Class 1 (≥ 0.45 W/cm^2)
13. Limited Commercial Warranty: 25 years

2.04 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.

B. Adhesives: As recommended by Tarkett to meet site conditions
   1. Resilient Vinyl Floor Tile
      a. Tarkett RollSmart™
      b. Tarkett 959 Adhesive
      c. Tarkett 975 Two-Part Urethane Adhesive

2.05 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to Tarkett written instructions to ensure proper adhesion of Resilient Flooring.
   1. Prepare concrete substrates in accordance with ASTM F 710.
      a. Concrete floors must be free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, film-forming curing compounds, silicate penetrating curing compounds, sealing, hardening or parting compounds, alkaline salts, excessive carbonation or laitence, mold, mildew, and other foreign materials that may affect dissipation rate of moisture from the concrete, discoloration or adhesive bonding.
      b. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
      c. Perform moisture testing as recommended by manufacturer. Proceed with installation only after substrates have been tested and meet the minimum

requirements from the manufacturer in accordance with ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride or ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

d. A pH test for alkalinity must be conducted on the concrete floor prior to installation with results conforming to manufacturer requirements. If the test results are not within the acceptable range, then installation must not proceed until the problem has been corrected.

2. Wood subfloors must have a minimum 18" (45.7 cm) of cross-ventilated space beneath the bottom of the joist.
   a. The floor must be rigid, free of movement.
   b. Single wood and tongue and groove subfloors should be covered with ¼" (6.4 mm) or ½" (12.7 mm) APA approved underlayment plywood.
      1) Use ¼" (6.4 mm) thick underlayment panels for boards with a face width of 3" (76 mm) or less.
      2) Use ½" (12.7 mm) thick underlayment panels for boards with a face width wider than 3" (76 mm).
   c. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.

B. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Floor covering shall not be installed over expansion joints.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 RESILIENT TILE FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient tile flooring.

B. Luxury Vinyl Tile Flooring:
   1. Install with Tarkett adhesive specified for the site conditions and follow adhesive label for proper use.
   2. Follow Tarkett’s recommendation for tile orientation.
   3. Open enough cartons of floor tiles to cover each area and mix tile to ensure shade variations do not occur within any one area.
   4. Roll the flooring in both directions using a 100 pound three-section roller.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
   1. No traffic for 24 hours after installation.
   2. No heavy traffic, rolling loads, or furniture placement for 48 hours after installation.

D. Wait 48 hours after installation before performing initial cleaning.

E. A regular maintenance program must be started after the initial cleaning.

END OF SECTION

SECTION 096519.33 – RUBBER TILE FLOORING

PART 1 – GENERAL

1.01 SUMMARY

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications. Section includes: Resilient Rubber Tile Flooring and accessories.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Section 09 65 19 Resilient Vinyl Flooring (LVT)
2. 2. Section 09 65 19.33 Rubber Tile Flooring

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 03 30 00 Cast-In-Place Concrete.

2. Section 06 10 00 Rough Carpentry.

C. References (Industry Standards):

1. ASTM International (ASTM):

a. ASTM F1344, Standard Specification for Rubber Tile Flooring
b. ASTM E648, Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
c. ASTM E662, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
d. CAN/ULC-S102.2, Test Method for Surface Burning
e. ASTM D2240 , Standard Test Method for Rubber Property—Durometer Hardness
f. ASTM F970, Standard Test Method for Static Load Limit
g. ASTM F970 (Modified), Test Method for Max Weight

h. ASTM F925, Standard Test Method for Resistance to Chemicals of Resilient Flooring
i. ASTM D2047, Standard Test Method for Static Coefficient of Friction as Measured by the James Machine
j. ASTM F1514, Standard Test Method for Measuring Heat Stability of Resilient Flooring by Color Change
k. ASTM D3389, Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader)
l. ASTM F2199, Standard Test Method for Determining Dimensional Stability of Resilient Floor Tile After Exposure to Heat
m. ASTM G21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
n. ASTM E492/E989, Standard Test Method for Measurement of Impact Sound Transmission
o. ASTM E90 / E413, Classification for Rating Sound Insulation

p. ASTM E2179, Standard Test Method for Measurement of the Effectiveness of Floor Covering in Reducing Impact Sound Transmission
q. ASTM F710, Standard Practice for Preparing Concrete to Receive Resilient Flooring
r. ASTM F1482, Standard Guide to Wood Underlayments products Available for Use Under Resilient Flooring

2. National Fire Protection Association (NFPA):

a. NFPA 253, Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source

b. NFPA 258, Test Method for Specific Density of Smoke Generated by Solid Materials

1.03 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures.

B. Product Data: Submit manufacturer's installation instructions and technical data sheet, care & maintenance document, submittal and/or warranty for each material and accessory proposed for use.

C. Samples: Submit representative samples of each product specified for verification, in manufacturer's standard size samples of each resilient product color, texture and patter required.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide resilient rubber tile flooring and accessory materials manufactured in the United States of America by a firm with a minimum of 10 years' experience with resilient flooring materials of type equivalent to those specified.
   1. Provide resilient flooring tread products, including risers, stringers, and subfloor preparation products from one manufacturer to ensure color matching and compatibility.
   2. Manufacturer shall be capable of providing technical training and technical field service representation.

B. Installer Qualifications: Installer must be professional, licensed, insured and acceptable to manufacturer of resilient stair tread materials. Project Managers or Field Supervisors must be INSTALL (International Standards & Training Alliance) certified CFI (Certified Floorcover ing Installers) Certified and/or an FCICA (The Flooring Contractors Association) CIM (Certi fied Installation Manager) for the requirements of the project.

C. Sustainable Design Requirements:

   1. Rubber Tile must be easily cleaned and does not require coatings and strippers, or use chemicals that may be hazardous to human health.
   2. Rubber Tile must have a published EPD.
   3. Rubber Tile must have a published HPD.
   4. Rubber Tile must have is 100% Recyclable.
   5. Rubber Tile must have be SCS FloorScore® Certified and meets California Specifications Section 01350.
   6. Rubber Tile must be free of materials known to be teratogenic, mutagenic or carcinogenic including halogens, asbestos and chlorines.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's recommendations. Protect from damage due to weather, excessive temperatures, and construction operations.
B. Deliver materials sufficiently in advance of installation to condition materials to the required temperature for 48-hours prior to installation.

1.06 PROJECT CONDITIONS

A. Install Rubber Tile after other finishing operations, including painting, have been completed.
B. Maintain temperature at service levels and/or the ambient temperature must remain steady (± 10° F) between 65° F and 85° F for at least 48-hours prior to, during and until substantial completion.
C. Maintain relative humidity at service levels, or between 40% and 65% RH.
D. Avoid conditions in which dew point causes condensation on the installation surface.

1.07 WARRANTY

A. Provide manufacturer’s standard limited commercial warranty to cover manufacturing defects.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis-of-Design: Roppe Corporation | 1602 N Union St. | Fostoria, OH 44830 | P: (800) 537-9527
B. Substitutions: Approved equal.

2.02 PRODUCTS

A. HOMOGENEOUS RESILIENT RUBBER TILE FLOORING

1. Roppe ‘SMOOTH AND RAISED DESIGN’ RUBBER TILE or approved equal.
2. 3/16” - Thickness (nominal thickness shall conform to industry standards and shall contain no asbestos fiber)
3. Profile – Smooth 970
4. Size is 19 11/16” X 19 11/16” AND 12” x 12” tile. Material shall conform to all standards and shall contain no asbestos fiber
5. Colors – M187 Blue, M186 Red, M643 Mimosa, M646 Grecko, M660 Citrus M662 Envy.
   a. Roppe Raised Design rubber tiles risers and stringers are solid, homogeneous, vulcanized rubber.
   b. ASTM F1344 – Rubber Floor Tile: Class I, Type A & B, Grade 1
   c. ASTM E648 (NFPA 253) - Critical Radiant Flux: Class I, > 0.45 W/cm2
   d. ASTM E662 (NFPA 258) - Smoke Density: Passes, < 450
   e. CAN/ULC-S102.2 - Surface Burning: Flame Spread Rating (FSR) 115, Smoke Developed Classification (SDC) 275
   f. ASTM D2240 - Shore A Hardness: > 85
   g. ASTM F970 - Static Load Limit: Passes, 250 PSI
   h. ASTM F970 (Modified) - Max Weight: 1100 PSI
   i. ASTM F925 – Chemical Resistance: Passes
   j. ASTM D2047 – Slip Resistance: > 0.6
   k. ASTM F1514 - Heat Color Stability: Passes, ΔE < 8
   l. ASTM D3389 - Abrasion Resistance: Passes, < 1 g loss (1000 cycles)
   m. ASTM F2199 - Dimensional Stability: Passes, < 0.15% (MD & AMD)
   n. ASTM G21 - Resistance to Fungi: Excellent

o. ASTM E492/E989 – Impact Sound: IIC 51
p. ASTM E90 / E413 – Airborne Sound: STC 63
q. ASTM E2179 – Effectiveness of Floor: ΔIIC 9

2.03 INSTALLATION AND MAINTENANCE MATERIALS

A. Moisture Mitigation: Moisture testing is required for all Envire Rubber Sheet & Tile installations. Mitigation should be performed if results indicate high levels of moisture. Recommended Moisture Mitigation Product:
1. Excelsior MM-100, Moisture Mitigation provided by Roppe
a. Unit Size: 2.5 Gallons
b. Coverage: 1000 square feet per unit with one coat
c. MM-100 is a water, solvent and VOC free, polyurethane-based moisture mitigation product used to treat concrete slabs with excessive moisture levels beyond what flooring adhesives allow.
d. MM-100 can block moisture up to 20 lbs. MVER or 99% RH.
e. MM-100 is a single component product, eliminating extensive mix times and concerns regarding pot life.
f. MM-100 does not require aggressive concrete preparation.
g. MM-100 is not recommended as a moisture mitigation system over a non-porous substrate. The substrate must be porous as per ASTM F3191 with 90% of the original substrate exposed.
h. MM-100 is a two coat system that is incredibly easy to apply and does not require any specialized equipment, its excellent coverage rates also make it incredibly cost effective.
i. Despite being a two coat system, MM-100 is incredibly fast drying.
j. Flooring or subsequent coatings can be installed in less than two hours.
k. Backed by a 10 year material and labor warranty, MM-100 is a fast and easy solution for the moisture issues that commonly plague flooring installations.

B. Substrate Preparation Products: Substrates should be prepared to properly receive the resilient flooring products being specified. Trowelable leveling and patching compounds that are latex-modified, Portland cement based or blended hydraulic cement based formulation. Recommended Substrate Preparation Products:
1. Excelsior NP-230, Non-Porous Substrate Primer provided by Roppe
a. Unit Size: 2.5 Gallons
b. Coverage: 1000 Square Feet per unit with one coat
c. Used over MM-100 to promote adhesion of cementitious materials
d. Single component and fast drying to allow for quick and easy installation
e. Contains an aggregate to provide mechanical bond for cementitious materials
2. Excelsior CP-300, Cementitious Patch provided by Roppe
a. Unit Size: 10 lb. Pail
b. Coverage: 33 Square Feet per unit @ 1/8”
c. Doesn’t require primer over porous substrates
d. Install flooring in as little as 30 minutes
3. Excelsior SU-310, Self-Leveling Underlayment provided by Roppe
a. Unit Size: 50 lb. Bag
b. 5500 PSI Compressive Strength after 28 days
c. Install flooring within 12 hours
d. Pumpable

C. Adhesives: Adhesives should be selected based on the site conditions and use of the space being installed. Recommended Adhesive Products:
1. Excelsior SP-500, Acrylic Aerosol Pressure Sensitive Spray Adhesive provided by Roppe
a. Unit Size: 22 Ounces

b. Coverage: 100 Square Feet per 22 Ounce Can
c. Should only be used if Heat Welding finished seams
d. Standard installations over porous and non-porous substrates
e. Excellent sheer strength
f. Approved for Hill-Rom Beds
g. Approved for Immediate Use
h. Installation Limits
(1) 90% RH, ASTM F2170
(2) 8 lbs. MVER, ASTM F1869
(3) 7-10 pH

2. Excelsior AP-520, Acrylic Roll-On/Trowelable Pressure Sensitive Adhesive provided by Roppe
a. Unit Size: 3 Gallons
b. Coverage: 1200 Square Feet per Unit
c. Should only be used if Heat Welding finished seams
d. Standard installations over porous and non-porous substrates
e. Excellent sheer strength
f. Approved for Hill-Rom Beds
g. Approved for Immediate Use
h. Installation Limits
(1) 90% RH, ASTM F2170
(2) 6 lbs. MVER, ASTM F1869
(3) 7.9 pH

3. Excelsior AW-510, Acrylic Wet-Set Adhesive provided by Roppe
a. Unit Size: 1 Gallon & 4 Gallon
b. Coverage: 150 Square Feet
c. Standard installations over porous and non-porous substrates
d. Hard set adhesive adding to dimensionally stable materials
e. Excellent sheer strength
f. Approved for Hill-Rom Beds
g. Installation Limits
(1) 90% RH, ASTM F2170
(2) 6 lbs. MVER, ASTM F1869
(3) 7-10 pH

4. Excelsior MS-700, Modified Silane Wet-Set Adhesive provided by Roppe
a. Unit Size: 3 Gallon
b. Coverage: 480-705 Square Feet per unit
c. Standard installations over porous and non-porous substrates
d. Excellent green grab
e. Hard set adhesive adding to dimensionally stable materials
f. Excellent sheer strength
g. Approved for Hill-Rom Beds
h. Superior bond strength
i. Great for environments with topical moisture
j. Great for exterior applications
k. Installation Limits, Indoor Installations only
(1) 95% RH, ASTM F2170
(2) 10 lbs. MVER, ASTM F1869

5. Excelsior EW-710, Epoxy Wet-Set Adhesive provided by Roppe
a. Unit Size: 1 Gallon
b. Coverage: 150 Square Feet per unit
c. Standard installations over porous and non-porous substrates
d. Excellent green grab
e. Hard set adhesive adding to dimensionally stable materials
f. Excellent sheer strength
g. Approved for Hill-Rom Beds

h. Superior bond strength
i. Great for environments with topical moisture
j. Great for exterior applications
k. Installation Limits, Indoor Installations only
(1) 90% RH, ASTM F2170
(2) 6 lbs. MVER, ASTM F1869
(3) 7-10 pH

D. Maintenance Materials: Proper maintenance of the installation is critical to the long term performance of the flooring products being specified. Using the appropriate chemicals to maintain the product according to the environment in which it is specified is critical. Recommend maintenance products:

1. Excelsior NC-900, All-Purpose Neutral pH Cleaner provided by Roppe
   a. For initial maintenance.
   b. For daily and routine maintenance.
2. Excelsior CM-910, Cleaner/Maintainer provided by Roppe
   a. For daily or long-term maintenance.
   b. Has a slight polymer to restore the luster of the product while providing cleaning efficacy.
3. Excelsior PF-960, High Performance Floor Finish for ease of floor maintenance, provided by Roppe.
   a. Creates a protective wear layer that protects flooring and eases maintenance.
4. Excelsior PR-930, High Performance Finish Remover, provided by Roppe.

PART 3 – EXECUTION

3.01 GENERAL

A. General Contractor Responsibilities:

1. Supply a safe, climate controlled building and subfloor as detailed in Roppe Installation Instructions and Technical Data documents.
2. Ensure substrate meets the requirements of ASTM F2169, Roppe Installation Instructions and Technical Data documents and Excelsior Installation Instructions and Technical Data documents.
3. Provide a secure storage area that is maintained permanently or temporarily at normal operating temperature and humidity conditions between 65° F and 85° F and between 40% and 65% relative humidity, for at least 48-hours prior to and during the application of the flooring, so the flooring contractor can acclimate the flooring materials per manufacturer's instructions.
4. Provide an installation area that is weather tight and maintained either permanently or temporarily at ambient service temperature and humidity. Normal operating temperature and humidity conditions are between 65° F and 85° F and between 40% and 65% relative humidity, for at least 48-hours prior to and during the application of the flooring per the manufacturer's instructions.
5. Ensure areas with direct prolonged exposure to sunlight are protected with protective UVA/UVB restrictive coatings or films.
6. Areas of the flooring that are subject to direct sunlight through doors or windows should have them covered using blinds, curtains, cardboard or similar for the time of the installation and 72-hours after the installation to allow the adhesive to cure. Note: These areas should be installed using wet adhesives only.
7. Conduct initial maintenance prior to final usage per the Roppe Care & Maintenance Documents. Do not conduct initial maintenance until adhesive has cured per the adhesive technical data.

B. Contractor Responsibilities:

1. Flooring Provide trained installers that are professional, licensed, insured and familiar with the resilient flooring material to be installed.

2. Ensure installers or installation teams meet one of the following requirements:
   a. Have completed INSTALL (International Standards & Training Alliance) or CFI (Certified Floorcovering Installers) training programs and/or are certified by INSTALL or CFI.
   b. Are being supervised by Project Managers or Field Supervisors that are INSTALL (International Standards & Training Alliance) certified.
   c. CFI (Certified Floorcovering Installers) Certified and/or an FCICA (The Flooring Contractors Association).
   d. CIM (Certified Installation Manager).
3. Follow all requirements in the appropriate Roppe and/or Excelsior Technical Data Sheets, Care & Maintenance Documents, Warranties and other technical documents or instructions.

3.02 EXAMINATION

A. General: Follow guidelines laid out in Division 01, Section 01 71 00 – Examination and Preparation, as well as Section 01 43 00 – Quality Assurance.

B. Verification of Conditions: Inspect all substrates to ensure they are clean, smooth, permanently dry, flat, and structurally sound. Confirm all areas are properly sealed and acclimated per manufacturer's requirements.

C. Verification of Products: In accordance with manufacturer's installation requirements, visually inspect material for size, color or visual defects prior to installing. Any material that is incorrect or visually defective shall not be installed.

3.03 SUBSTRATE PREPARATION

A. General: Follow guidelines laid out in Division 01, Section 01 71 00 – Examination and preparation. All work required ensuring substrate or subfloor meets manufacturers' guidelines are the responsibility of the general contractor.
   1. Ensure surface is troweled flush with surface of concrete.
   2. Follow material manufacturer's as well as adhesive manufacturer's instructions for installation.

B. Preparation: Ensure substrate meets the requirements of ASTM F710 for concrete substrates and ASTM F1482 for wood substrates and/or Roppe Technical Data Sheets and Excelsior Technical Data Sheets.
   1. Substrates must be free of visible water or moisture, dust, sealers, paint, sweeping compounds, curing compounds, residual adhesives and adhesive removers, concrete hardeners or densifiers, solvents, wax, oil, grease, asphalt, visible alkaline salts or excessive efflorescence, mold, mildew and any other extraneous coating, film, material or foreign matter.
   2. Acclimate all products to be used during the installation and the installation environment prior to installation according to the manufacturers written instructions.

C. Concrete Substrates:
   1. Moisture Testing: Perform moisture testing per the manufacturer's recommendations to determine conditions, it is recommended to treat new and existing slabs a little bit different to ensure adequate conditions exist for installation.
      a. New concrete substrates: it is recommended to perform ASTM F2170 Relative Humidity testing no more than a week prior to installation to determine the levels present and when to proceed with the installation.
      b. Existing concrete substrates: in addition to ASTM F2170 testing, existing slabs that have previously had floor covering installed, must be tested to ASTM F1869 Calcium Chloride test kits to determine the MVER of the concrete.
   2. Mechanically remove contamination on the substrate that may cause damage to the flooring material, this includes paint, permanent and non-permanent markers, pens,

crayons, etc. Leaving these on the substrate or marking with them on the back of the material could cause bleed through and damage the flooring.

3. Fill cracks, holes, depressions and irregularities in the substrate to prevent transferring through to the surface of the resilient flooring. Use a high-quality Portland cement based product such as Excelsior installation products provided by Roppe.

D. Wood Substrates: wood substrates must have a minimum 18" (45.7 cm) of cross ventilated space beneath the joist.

1. Wood substrates must be a minimum 1" thick with a double layer construction.
2. Wood substrates must be rigid and free of movement.
3. Wood substrates must not be OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.

3.04 INSTALLATION

A. General: Follow all relevant guidelines detailed in Division 01, as well as flooring and adhesive manufacturer's technical data sheets.

B. Resilient Rubber Tiles: Install material in accordance with manufacturer's recommendations.

1. Select the appropriate adhesive for the application and job site conditions
2. Install material according to roll sequence or with like run numbers
3. Install material according to directional arrow on the back of the material and do not reverse sheets
4. Ensure material is rolled appropriately into the adhesive using a 100 lb. three section roller
5. Heat Weld seams if required by the area in which the material is being installed.
   a. Heat Welding (Seamless Floors): Material shall be grooved to accept Roppe rubber weld bead. Roppe rubber 4mm (0.160") weld bead shall be installed according to manufacturer's recommended installation documents.
   b. Do not heat weld for 24 hours to allow adhesive to fully cure.

C. Interface with Other Work: If caulking or sealing is required after installation, please contact the manufacturer for a suitable, color matching caulk.

3.05 CLEANING & MAINTENANCE

D. General: Clean up installation area using dust mop or vacuum or wipe material to remove any dirt, dust or debris.

E. Initial Maintenance: Conduct initial maintenance per the manufacturer's recommended procedures stated in the Maintenance Documents. All documentation is available upon request or from the Roppe website. Excelsior Cleaning products and floor finishes are the recommended products for use. All can be found linked to the product on the Roppe website or at www.excelsiorproducts.net.

F. Regular Maintenance: Conduct maintenance on regular intervals as needed. Insufficient cleaning will reduce the wear life of the flooring and alter the dissipative properties of the tiles. The amount of maintenance depends directly upon the amount of dirt and particulates the floor is subjected to.

3.06 CLOSEOUT ACTIVITIES

G. General: Follow all federal, state and local requirements and Division 01 Section 01 76 00 – Protecting Installed Construction and Section 01 78 00 – Closeout Submittal requirements for these activities.

H. Protection: Protect newly installed material with construction grade paper or protective boards, such as Masonite or Ram Board, to protect material from damage by other trades. Be sure all construction debris is vacuumed up and / or removed prior to the protective material being installed and does not get trapped underneath. Limit usage and foot traffic according to the adhesive's requirements. When moving appliances or heavy furniture, protect flooring from scuffing and tearing using temporary floor protection as well.

END OF SECTION

SECTION 096536 - STATIC DISSIPATIVE RESILIENT VINYL FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

B. Section Includes:
   1. Resilient Honogeneous Vinyl Sheet Flooring.

1.03 SUBMITTALS

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

D. Sustainability Submittals:

   1. Product Data for Credit EQ 4.1: For adhesives, include printed statement of VOC content and chemical components.

E. Samples for Initial Selection: For each type of product indicated.

F. Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.

G. Product Schedule: For resilient products. Use same designations indicated on Drawings**.**

1.04 QUALITY ASSURANCE

H. Installation Qualification: Contractors for floor covering installation should be experienced in managing commercial flooring projects and provide professional installers, qualified to install the various flooring materials specified. An installer is “qualified” if trained, or a certified by Tarkett or a certified INSTALL (International Standards & Training Alliance) resilient floor covering installer.

I. Mockups: Provide resilient products with mockups specified in other Sections.

1.05 DELIVERY, STORAGE, AND HANDLING

J. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Tarkett, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.06 PROJECT CONDITIONS

K. Install resilient products after other finishing operations, including painting, have been completed.

L. Maintain ambient temperatures within range recommended by Tarkett, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

M. Maintain the ambient relative humidity between 40% and 60% during installation.

N. Until Substantial Completion, maintain ambient temperatures within range recommended by Tarkett, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

PART 2 - PRODUCTS

2.01 RESILIENT SHEET FLOORING

Manufacturer:

Tarkett North America
30000 Aurora Rd.
Solon, Ohio 44139
Web: www.tarkettna.com

Phone: (800) 899-8916
(440) 543-8916

2.02 IQ TORO SC VINYL SHEET FLOORING

A. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite, a Tarkett Company; iQ Toro SC or approved equal.

B. Sheet Standard: ASTM F1913, Standard Specification for Vinyl Sheet Floor Covering Without Backing.

C. Thickness/Wearlayer: 0.080 inch (2.0 mm).

D. For size specify: 6 ft. 6 inches (2 m), refer to drawings.

E. Colors and Patterns: To be selected by Architect.

F. Test data:
   1. Flexibilty (ASTM F137): Passes
   2. Chemical Resistance (ASTM F925): Passes
   3. Static Load Limit (ASTM F 970): Passes 250 psi, $\leq$ 0.005”
   4. Resistance to Light (ASTM F1515): $\Delta E \leq 8$
   5. Residual Indentation (ASTM F1914): Passes
   6. Static Coefficient of Friction (ASTM D 2047): $\geq$ 0.5 SCOF
   7. Flamability (ASTM E648, Critical Radiant Flux): Class 1 ($\geq$ 0.45 W/cm^2)
   8. ESD-approval SP-method 2472: $\leq 10^9$ Ohms
   9. EN 1081: 5×10^4 - 10^6 Ohms
   10. EN/IEC 61340-4-1, 100 V: 5×10^4 - 10^6 Ohms
   11. EN/IEC 61340-4-5: $\leq 3.5 \times 10^7$ Ohms
   12. Limited Commercial Warranty: 20 years

2.03 IQ TORO SC VINYL TILE FLOORING

A. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite, a Tarkett Company; iQ Toro SC.

B. Sheet Standard: ASTM F1700, Standard Specification for Solid Vinyl Tile Floor Covering.

C. Thickness/Wearlayer: 0.080 inch (2.0 mm).

D. For size specify: 24 inch x 24 inch (61 cm x 61 cm), refer to drawings.

E. Colors and Patterns: Toro Grey 101.

F. Test data:

G. Test data:
1. Flexibilty (ASTM F137): Passes
2. Chemical Resistance (ASTM F925): Passes
3. Static Load Limit (ASTM F 970): Passes 250 psi, ≤ 0.005”
4. Resistance to Light (ASTM F1515): $\Delta E \leq 8$
5. Residual Indentation (ASTM F1914): Passes
6. Static Coefficient of Friction (ASTM D 2047): ≥ 0.5 SCOF
7. Flamability (ASTM E648, Critical Radiant Flux): Class 1 (≥ 0.45 W/cm^2)
8. ESD-approval SP-method 2472: ≤ 10^9 Ohms
9. EN 1081: 5 x 10^4 - 10^6 Ohms
10. EN/IEC 61340-4-1, 100 V: 5 x 10^4 - 10^6 Ohms
11. EN/IEC 61340-4-5: ≤ 3.5 x 10^7 Ohms
12. Limited Commercial Warranty: 20 years

2.04 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.

B. Adhesives: As recommended by Tarkett to meet site conditions
1. Tarkett 906 Conductive Adhesive
2. Tarkett 925 Resilient Flooring Adhesive
3. Tarkett 975 Two-Part Urethane Adhesive
4. Cold Weld Liquid

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to Tarkett written instructions to ensure proper adhesion of Resilient Flooring.
1. Prepare concrete substrates in accordance with ASTM F 710.
a. Concrete floors must be free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, film-forming curing compounds, silicate penetrating curing compounds, sealing, hardening or parting compounds, alkaline salts, excessive carbonation or laitence, mold, mildew, and other foreign materials that may affect dissipation rate of moisture from the concrete, discoloration or adhesive bonding.
b. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must

not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.

c. Perform moisture testing as recommended by manufacturer. Proceed with installation only after substrates have been tested and meet the minimum requirements from the manufacturer in accordance with ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride or ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

d. A pH test for alkalinity must be conducted on the concrete floor prior to installation with results between 7 and 9. If the test results are not within the acceptable range, then installation must not proceed until the problem has been corrected.

2. Wood subfloors must have a minimum 18" (45.7 cm) of cross-ventilated space beneath the bottom of the joist.
   a. The floor must be rigid, free of movement.
   b. Single wood and tongue and groove subfloors should be covered with ¼" (6.4 mm) or ½" (12.7 mm) APA approved underlayment plywood.
      i. Use ¼" (6.4 mm) thick underlayment panels for boards with a face width of 3" (76 mm) or less.
      ii. Use ½" (12.7 mm) thick underlayment panels for boards with a face width wider than 3" (76 mm).
   c. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.

B. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Floor covering shall not be installed over expansion joints.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Solid Vinyl Tile Flooring:
   1. Install with Tarkett adhesive specified for the site conditions and follow adhesive label for proper use.
   2. Follow Tarkett’s recommendation for tile orientation.
   3. Open enough cartons of floor tiles to cover each area, and mix tile to ensure shade variations do not occur within any one area.
   4. Roll the flooring in both directions using a 100 pound three-section roller.

C. Resilient Sheet Flooring:
   1. Install with Tarkett adhesive specified for the site conditions and follow adhesive label for proper use.
   2. Install rolls in sequential order following roll numbers on the labels.
   3. Reverse non-pattern sheets as referenced in the Tarket Installation Instructions.
   4. Roll the flooring in both directions using a 100 pound three-section roller.
   5. Vinyl sheet flooring must be welded.
      Note: It is recommended to heat weld seams to provide a more sterile and water tight seam.
   6. Tarkett Resilient Sheet Flooring may be flash coved.
      a. Use Johnsonite CFS-00-A Cove Filler Strip.

b. Net fit flooring material into the appropriate Johnsonite cove cap.

3.04 CLEANING AND PROTECTION

D. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

E. Perform the following operations immediately after completing resilient product installation:
1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

F. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
1. No traffic for 24 hours after installation.
2. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

G. Wait 72 hours after installation before performing initial cleaning.

H. A regular maintenance program must be started after the initial cleaning.

END OF SECTION

SECTION 096566 - RESILIENT ATHLETIC FLOORING

SPORTFLEX M (8mm)

1 PART 1 – GENERAL

1.1 SUMMARY

1.1.1 Products Supplied

A. Resilient Athletic Flooring.
B. Accessories required for installation, line marking (if specified), maintenance and repair.

1.1.2 Related Requirements

A. Section 03 00 00 –Concrete
B. Division 7

1.2 REFERENCES

1.2.1 Association(s)

A. National Collegiate Athletic Association (NCAA).
B. National Federation of State High School Association (NFHS).
C. International Tennis Federation (ITF).

1.2.2 ASTM International (ASTM)

A. ASTM D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
B. ASTM D2240: Standard Test Method for Rubber Property (Durometer Hardness).
C. ASTM D3389: Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader).
D. ASTM E648: Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
E. ASTM E1643: Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
F. ASTM E1745: Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
G. ASTM F387: Standard Test Method for Measuring Thickness of Resilient Floor Covering With Foam Layer.
H. ASTM F710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
I. ASTM F925: Standard Test Method for Resistance to Chemicals of Resilient Flooring.
J. ASTM F1514: Standard Test method for Measuring Heat Stability of Resilient Flooring by Color Change.
K. ASTM F1515: Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change.
L. ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
M. ASTM F2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

N. ASTM F3010: Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.

1.2.3 Florida (FL)

A. FBC 2020 – FLORIDA BUILDING CODE 2020

1.2.4 Grenelle Environment Forum

A. Decree № 2011-321. French decree on labeling requirement for construction materials, wall and floor coverings, and paint and varnishes, as it pertains to their emissions of volatile pollutants.

1.2.5 GREENGUARD Environmental Institute (GEI)

A. GREENGUARD Certification. Compliant with stringent emission levels for over 360 VOCs, plus a limit on the total of all chemical emissions combined (TVOC).
B. GREENGUARD Gold. Compliant with safety factors to account for sensitive individuals (such as children and the elderly) and ensures that a product is acceptable for use in environments such as schools and healthcare facilities.

1.2.6 International Organization for Standardization (ISO)

A. ISO 9001: Quality management systems – Requirements.
B. ISO 14001: Environmental management systems – Requirements with guidance for use.
C. ISO 16000-9: Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method.

1.3 SUBMITTALS

1.3.1 Action Submittals

A. Upon City request, provide a copy of Original Equipment Manufacturer (OEM)'s ISO 9001 and ISO 14001 certificates.
B. Provide current printed technical data sheets (TDS) and guide specifications from manufacturer for all Products Supplied.
C. Provide one (2) sample of each color of Resilient Athletic Flooring specified, for verification and approval.
D. If line painting has been specified and upon City request, Flooring Contractor/Line Marker to provide samples of available paint colors for selection and approval. Provide mock up samples on site for approval by City and design team.
E. General Contractor to provide accurate shop drawings prepared for the project that illustrate layouts, details, dimensions and other pertinent data useful to the Flooring Contractor and/or Line Marker.

1.3.2 Informational Submittals

A. Provide Manufacturer's current printed substrate surface preparation guidelines.
B. Provide Manufacturer's current printed installation guidelines for Products Supplied.

1.3.3 Closeout Submittals

A. Provide Manufacturer's current printed maintenance guidelines for Manufactured Product.
B. Provide a numbered certificate of the current printed Mondo Limited Material Warranty for the Manufactured Product installed.

1.3.4 Maintenance Material Submittals

A. It is highly recommended to purchase extra stock material from the original dye lot used, for the purpose of facility operations and maintenance (approximately 2% of the total floor surface for each color of Manufactured Product specified).
B. Provide training to Citys staff for proper maintenance. Provide video tape of training and instructions.

1.4 QUALITY ASSURANCE

A. Resilient Athletic Flooring must be manufactured in an ISO 9001 and ISO 14001 certified plant.
B. Manufacturer must have a minimum of fifteen (15) years of experience in the manufacturing of prefabricated resilient rubber flooring.
C. Manufactured Product must have undergone a vulcanization process; factory lamination should not be accepted as equivalent.
D. Flooring Contractor to be recognized and approved by the Manufacturer.
E. Flooring Contractor to have completed at least ten (10) multipurpose/track and field facilities in North America, and that have been properly certified (when applicable) to meet specified Association requirements for desired level of competition.
F. Flooring Contractor shall be fully acquainted with the existing facility and utilities and shall fully understand the difficulties and restrictions attending the execution of the work under contract. Flooring Contractor is responsible for immediately advising the City, in writing, of any restrictions or anticipated difficulty.
G. Installer must be approved by the Flooring Contractor and must have performed installations of the same scale in the last three (3) years.
H. Flooring Contractor must ensure that a designated Project Manager or Superintendent be on site every day to supervise the installation of the Manufactured Product. Substitution of Project Manager or Superintendent shall not be permitted.
I. If line marking is specified, the Line Marker shall be approved by the Flooring Contractor. Painting must be done by professionals with proper experience and qualifications to effectively perform the work; Line Marker to have painted a minimum of twenty (20) multipurpose/track and field facilities in North America, and that have been properly certified (when applicable) to meet specified Association requirements for desired level of competition.
J. Bond tests is required.
K. Mock-up installation; always follow the same procedures and use the same materials that have been specified for the actual project. The City will be responsible for deeming the mock-up acceptable.- Minimum mock-up size: 24 inch by 24 inch

1.5 DELIVERY, STORAGE AND HANDLING

A. Products Supplied must be delivered in the Manufacturer's original, unopened, and undamaged packaging with identification labels intact.
B. Products Supplied must be protected from exposure to harmful weather conditions and must be safely stored on a clean, dry, flat surface. Store rolls of Resilient Athletic Flooring upright.
C. Climate controlled storage is recommended. Storage temperature must not be below 40^{o}F (4^{o}C) and must not exceed 100^{o}F (38^{o}C). Materials must be delivered to the site a

minimum of 24 hours before work is scheduled to begin so that they may acclimate.

D. Avoid storing Manufactured Product for extended periods of time or additional material trimming may be required.
E. Products Supplied need not suffer damage during delivery, storage and handling (i.e. dents/scratches, excessive compression or warping, chipped edges, etc.).

1.6 SITE CONDITIONS

A. The General Contractor or Construction Manager shall be responsible for ensuring all site conditions meet the Manufacturer's requirements, as referenced herein at sections 3.2 and 3.3. Refer to current version of ASTM F710 for additional information.
B. Concrete slabs, on or below grade, must be installed over a permanent effective vapor retarder, respecting current versions of the standard practice ASTM E1643 and the standard specification ASTM E1745. The vapor retarder must be placed directly underneath the concrete slab, above the granular fill, as per Manufacturer's instructions. The vapor retarder must have a perm rating of 0.1 or less and must have a minimum thickness of 10 mil (0.010 in).
C. No sealers or curing compounds are applied to or mixed into the concrete (refer to Section 03 05 00 – Common Work Results for Concrete of Division 3).
D. Installation of the Resilient Athletic Flooring to be carried out no sooner than the specified curing time of the concrete (normal density concrete curing time is approximately 28 days for development of design strength, having a minimum 3500 psi or 25 MPa in compressive strength).
E. Substrate surface must be free of all contaminants that can inhibit bond (paint, wax, dust, oil or grease, sealer, curing compound, solvent, asphalt, old adhesive residues, etc.). All contaminants must be removed from the surface via mechanical abatement. Use of abatement chemicals is not recommended.
F. Concrete must have a smooth finish, proper density and be highly compacted with a tolerance of $1/8^{th}$ of an inch in a 10-foot radius (3.2 mm in 3.05 m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.
G. Moisture and alkalinity tests must be performed on all concrete substrates, under in-service conditions. It is recommended to turn on the HVAC unit prior to performing moisture testing, in order to ensure stable testing conditions and accurate results. The concrete's surface pH should be between 7 and 10. Relative humidity of the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F2170 (in situ probes). Moisture vapor emissions from the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F1869 (anhydrous calcium chloride). Where tolerances are exceeded and a moisture mitigation system will be specified, refer to ASTM F3010.
H. If installing over a wood base, ensure exterior grade plywood with at least one good side, such as: APA (Engineered Wood Association) Exterior grade plywood (A-A Exterior, A-B Exterior or A-C Exterior) and CANPLY (Canadian Plywood Association) Exterior certified plywood (Canada: Grade G2S A-A or G1S A-C. USA: G2S A-A, A-B, B-B, or G1S A-C, B-C). There must be proper underfloor ventilation, plywood must be dry and should have a moisture content ranging between 6 and 12%, when measured with a quality wood moisture meter (electronic hygrometer).
I. Maintain stable room and substrate temperatures prior to moisture testing and Resilient Athletic Flooring installation, during the installation, as well as a minimum of 48 hours after the Resilient Athletic Flooring has been completely installed. Recommended ambient temperature range is between $65^{O}F$ and $86^{O}F$ ($18^{O}C$ and $30^{O}C$) and recommended ambient humidity range is between 35% and 55%.
J. Installation of Resilient Athletic Flooring will not commence until the building is

enclosed and all other trades have completed their work. It is the General Contractor or Construction Manager's responsibility to maintain a secure and clean working area before, during and after the installation of the Resilient Athletic Flooring.

1.7 LIMITED WARRANTY

A. The Resilient Athletic Flooring is warranted to be free from manufacturing defects for a period of one (1) year from the date that is maximum 90 days from shipment from Mondo, per the terms and conditions of Mondo's Limited Material Warranty.
B. For standard applications, the Resilient Athletic Flooring is warranted against excessive wear under normal usage for a period of ten (10) years from the date that is maximum 90 days from shipment from Mondo, per the terms and conditions of Mondo's Limited Material Warranty.
C. Refer to current copy of Mondo's Limited Material Warranty for all terms and conditions, which shall be obtained directly from Mondo. In no event shall any warranties provided by any third parties (including distributors, insurance and/or private label providers) be considered as valid.

2 PART 2 – PRODUCTS

2.1 MANUFACTURED PRODUCT

2.1.1 Manufacturer

A. Mondo S.p.A., Piazzale E. Stroppiana, 1, 12051 Alba, Fraz. Gallo – Italia.
B. Or approved equal with matching quantities, finishes, accessories & warranties.

2.1.2 Description

A. Sportflex M is prefabricated rubber athletic flooring, calendered and vulcanized with a particular closed cell structure, based on special isoprenic rubbers, mineral fillers, stabilizing agents and pigmentation, highly resistant to UV rays and atmospheric agents, with system of differential elasticity between top surface and base, as manufactured by Mondo S.p.A.
B. Manufactured in two layers which are vulcanized together. The shore hardness of the wear layer (top layer) will be greater than that of the bottom layer; shore hardness of layers to be recommended by the Manufacturer and shall respect the requirements specified.
C. Thickness: 0.394 in. (8 mm).
D. Colors: Available in standard, solid background colors. Consult standard colors for indoor applications.
E. Surface Texture: ATS embossing.
F. Format: Sheets available in widths from 3' (0.92 m) to 6' (1.83 m) and with an average length of 49'2" (15m) long [minimum 19'8" (6 m)/maximum 52'5" (16 m)].

2.1.3 Performance

A. Refer to Association performance requirements for desired level of competition.
B. Performance of Manufactured Product to conform to the listed Requirements:

Performance Criteria	Test Methods	Requirements	Results*
Elongation at Break	ASTM D412	≥100%	>160%

Tensile Strength	ASTM D412	≥75 psi	>140 psi
Hardness of wear layer (Shore A durometer)	ASTM D2240	55 ±5	55 ±5
Hardness of backing (Shore A durometer)	ASTM D2240	40 ±5	40 ±5
Abrasion Resistance (H18 wheel, 1000g, 1000	ASTM D3389	≤2.0 g	≤1.2 g
Critical Radiant Flux	ASTM E648	>0.1 W/cm^2	>0.45 W/cm^2 (Class
Thickness	ASTM F387	8 mm (±0.3 mm) 0.394 in (±0.011	8 mm (±0.3 mm) 0.394 in (±0.011
Resistance to Chemicals**	ASTM F925	≤ Slight Change	Compliant
Heat Stability	ASTM F1514	≤8.0 ΔE	Compliant
Light Stability	ASTM F1515	≤8.0 ΔE	Compliant
Slip/Skid Resistance (Dry)	EN 13036-4	80-110	90
Slip/Skid Resistance (Wet)	EN 13036-4	55-110	79
Indoor Air Quality: CA 01350	CA: V1.2-2017	Compliant	Compliant
Indoor Air Quality: Greenguard Certification	CA: V1.2-2017	Compliant	Compliant
Indoor Air Quality: Greenguard Gold	CA: V1.2-2017	Compliant	Compliant
Indoor Air Quality: French Decree № 2001-321	ISO 16000-9	Compliant	Compliant

*Result from third-party testing can vary between production lots, laboratories and methods, and as such do not constitute representations or warranties as to any particular production lot. Mondo reserves the right to modify product design and/or specifications at any time without notice.
**For the complete list of chemicals tested, concentrations and contact time, please communicate with Mondo's Technical Department.

2.1.4 Limitations

A. Sportflex M is not resistant to athletic footwear with spikes.

2.1.5 Materials

A. Resilient Athletic Flooring: Sportflex M manufactured by Mondo S.p.A., as specified in section 2.1.2 Description.

2.2 ACCESSORIES

A. Adhesive certified by Manufacturer: Mondo PU 105 (polyurethane) over concrete. For suitability, recommendations, and use, please refer to the specified adhesive's current printed technical data sheet. In some cases, Mondo EP 55 (epoxy) may be used in areas that have not been specified to receive Everlay, that will not be subject to surface impacts (such as falling free weights), and that will not have heavier dynamic loads (such as bleachers). For acceptable installations over Mondo Everlay products (where surface impacts and heavier dynamic loads are not a concern), please consult Mondo's Technical Department for current adhesive recommendations for these products.
B. Portland cement based patching or leveling compound to be recommended/approved by Manufacturer.
C. If line marking is specified, all painting products are to be recommended/approved by Manufacturer.

3 PART 3 – EXECUTION

3.1 INSTALLERS

A. Refer to section 1.4 of this document for information on installers.

3.2 EXAMINATION

A. Prior to Resilient Athletic Flooring installation, ensure substrate is ready to receive resilient flooring and has been prepared according to Manufacturer's current substrate surface preparation guidelines. Refer to current version of ASTM F710 for complimentary information.
B. Ensure that concrete slabs, on or below grade, are installed over a permanent effective vapor retarder, respecting current versions of the standard practice ASTM E1643 and the standard specification ASTM E1745. The vapor retarder must be placed directly underneath the concrete slab, above the granular fill, as per manufacturer's instructions. The vapor retarder must have a perm rating of 0.1 or less and must have a minimum thickness of 10 mil (0.010 in).
C. Ensure that concrete surface is free of any contaminant that could inhibit bond (paint, wax, dust, oil or grease, sealer, curing compound, solvent, asphalt, old adhesive residues, etc.). All contaminants must be removed from the surface via mechanical abatement. Use of abatement chemicals is not recommended.
D. Confirm concrete has a smooth finish, proper density and is highly compacted with a tolerance of $1/8^{th}$ of an inch in a 10-foot radius (3.2 mm in a 3.05 m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.
E. Moisture and alkalinity tests must be performed on all concrete substrates, under in-service conditions. It is recommended to turn on the HVAC unit prior to performing moisture testing, in order to ensure stable testing conditions and accurate results. The concrete's surface pH should be between 7 and 10. Relative humidity of the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F2170 (in situ probes). Moisture vapor emissions from the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F1869 (anhydrous calcium chloride). Where tolerances are exceeded and a moisture mitigation system will be specified, refer to ASTM F3010.
F. If installing over a wood base, ensure exterior grade plywood with at least one good side, such as: APA (Engineered Wood Association) Exterior grade plywood (A-A Exterior, A-B Exterior or A-C Exterior) and CANPLY (Canadian Plywood Association) Exterior certified plywood (Canada: Grade G2S A-A or G1S A-C. USA: G2S A-A, A-B, B-B, or G1S A-C, B-C). There must be proper underfloor ventilation, plywood must be dry and should have a moisture content ranging between 6 and 12%, when measured with a quality wood moisture meter (electronic hygrometer).
G. Ensure room and substrate temperatures are maintained prior to moisture testing and Resilient Athletic Flooring installation, during the installation, as well as a minimum of 48 hours after the Resilient Athletic Flooring has been completely installed. Recommended ambient temperature range is between 65^{O}F and 86^{O}F (18^{O}C and 30^{O}C) and recommended ambient humidity range is between 35% and 55%.
H. Installation of Resilient Athletic Flooring will not commence until the building is enclosed and all other trades have completed their work. It is the General Contractor or Construction Manager's responsibility to ensure that a secure and clean working area is maintained before, during and after the installation of the Resilient Athletic Flooring.

3.3 PREPARATION

A. Prepare concrete substrate surface or wood when applicable in accordance with Manufacturer's current printed guidelines.

3.4 INSTALLATION

A. Install sheets of Resilient Athletic Flooring Following Manufacturer's current printed guidelines.
B. Install all accessories following Manufacturer's current printed guidelines.
C. If line painting has been specified, Line Marker to paint all lines following the manufacturer's current printed guidelines, respecting any drawing(s) and the Project/Master Specification requirements. All lines markings shall be spray-applied.

3.5 REPAIR

A. Refer to section 1.3.4 Maintenance Materials. Repair material must come from the same original dye lot as initially installed Resilient Athletic Flooring.
B. Repairs are to be performed by Flooring Contractor's qualified installers/technicians only.

3.6 CLEANING

A. Always wait at least a minimum of 72 hours after the Resilient Athletic Flooring has been completely installed before performing initial maintenance. Always maintain the Resilient Athletic Flooring Following Manufacturer's current printed guidelines.
B. For surfaces having received newly painted lines, wait a minimum of 30 days after the application of the paint to ensure its proper curing before going over the surface with a scrubber/scrubbing the lines.

3.7 PROTECTION

A. As needed, protect Resilient Athletic Flooring with $1/8^{th}$ inch Masonite during and after the installation, prior to acceptance by City.
B. Preserve the integrity of the installation and protect against direct sunlight/UV exposure; always ensure that windows and glass doors have inherent UV protection and/or are fitted with blinds/UV film.
C. Contractor to provide all windows and glass doors with UV protection and/or are fitted with blinds/UV film. Contractor to verify and provide as necessary.

END OF SECTION

SECTION 096566.1 - RESILIENT ATHLETIC FLOORING

RAMFLEX (10mm)

1 PART 1 – GENERAL

1.1 SUMMARY

1.1.1 Products Supplied

A. Resilient athletic flooring.
B. Accessories required for installation, maintenance, and repair.

1.1.2 Related Requirements

A. Section 03 00 00 –Concrete

1.2 REFERENCES

1.2.1 ASTM International (ASTM)

A. ASTM D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
B. ASTM D2047: Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as measured by the James Machine.
C. ASTM D2240: Standard Test Method for Rubber Property (Durometer Hardness).
D. ASTM D3389: Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader).
E. ASTM E648: Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
F. ASTM E1643: Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
G. ASTM E1745: Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
H. ASTM E2180: Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials.
I. ASTM F386: Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces.
J. ASTM F710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
K. ASTM F925: Standard Test Method for Resistance to Chemicals of Resilient Flooring.
L. ASTM F970: Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading.
M. ASTM F1514: Standard Test method for Measuring Heat Stability of Resilient Flooring by Color Change.
N. ASTM F1515: Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change.
O. ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
P. ASTM F2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.2.2 State of Florida

A. Florida Building Code 2020 latest version and amendments.

1.2.3 Grenelle Environment Forum

A. Decree № 2011-321. French decree on labeling requirement for construction materials, wall and floor coverings, and paint and varnishes, as it pertains to their emissions of volatile pollutants.

1.2.4 GREENGUARD Environmental Institute (GEI)

A. GREENGUARD Certification. Compliant with stringent emission levels for over 360 VOCs, plus a limit on the total of all chemical emissions combined (TVOC).
B. GREENGUARD Gold. Compliant with safety factors to account for sensitive individuals (such as children and the elderly) and ensures that a product is acceptable for use in environments such as schools and healthcare facilities.

1.2.5 International Organization for Standardization (ISO)

A. ISO 9001: Quality management systems – Requirements.
B. ISO 16000-9: Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method.
C. ISO 22196: Measurement of antibacterial activity on plastics and other non-porous surfaces.

1.3 SUBMITTALS

1.3.1 Action Submittals

A. Provide copies of Original Equipment Manufacturer (OEM)'s ISO 9001 certification.
B. Provide current printed data sheets for all Products Supplied.
C. Provide samples, 6 inches x 6 inches, for verification of such characteristics as color and surface texture for each Manufactured Product specified.
D. As necessary, provide shop drawings prepared for projects illustrating layouts, details, dimensions and other pertinent data.

1.3.2 Informational Submittals

A. Provide Manufacturer's current printed substrate surface preparation guidelines.
B. Provide Manufacturer's current printed installation guidelines for Products Supplied.

1.3.3 Closeout Submittals

A. Provide Manufacturer's current printed maintenance guidelines for Manufactured Product.
B. Provide Manufacturer's current printed standard warranty for Manufactured Product.

1.3.4 Maintenance Material Submittals

A. Provide extra stock materials from original dye lots, for use in facility operations and maintenance (approximately 2% of the total floor surface for each color, surface texture and format of Manufactured Product specified).

1.4 QUALITY ASSURANCE

A. Manufacturer must be certified ISO 9001.
B. Manufacturer must have a minimum of fifteen (15) years of experience in the manufacturing of prefabricated resilient rubber flooring.
C. Manufactured Product must have undergone a vulcanization process; factory lamination should not be accepted as equivalent.
D. Surfacing Contractor to be recognized and approved by the Manufacturer.
E. The Surfacing Contractor shall be fully acquainted with the existing facilities and utilities and shall fully understand the difficulties and restrictions attending the execution of the work under contract. Surfacing Contractor to advise the City of any restrictions or anticipated difficulty, in writing and before submitting bids.
F. The installer must be approved by the Surfacing Contractor and must have performed installations of the same scale in the last three (3) years.
G. A mock-up installation is highly recommended; always follow the same procedures and use the same materials that have been specified for the actual project. The City or Architect will be responsible for deeming the mock-up acceptable. - Mock-up size: 24”X24” minimum

1.5 DELIVERY, STORAGE AND HANDLING

A. Products Supplied must be delivered in the Manufacturer’s original, unopened and undamaged packaging with identification labels intact.
B. Products Supplied must be protected from exposure to harmful weather conditions and must be safely stored on a clean, dry, flat surface. Store rolls of resilient athletic flooring upright; store tiles of resilient athletic flooring on a flat surface, carefully protecting corners and edges.
C. Climate controlled storage is recommended. Storage temperature must not be below 40^{O}F (4^{O}C) and must not exceed 100^{O}F (38^{O}C). Materials must be delivered to the site a minimum of 24 hours before work is scheduled to begin so that they may acclimate.
D. Avoid storing Manufactured Product for extended periods of time or additional material trimming may be required.
E. Products Supplied need not suffer damage during delivery, storage and handling (i.e. dents/scratches, excessive compression or warping, chipped edges, etc.).

1.6 SITE CONDITIONS

A. The General Contractor or Construction Manager shall be responsible for ensuring all site conditions meet the requirements of the Manufacturer, as referenced herein at sections 3.2 and 3.3. Refer to current version of ASTM F710 for additional information.
B. Concrete slabs, on or below grade, must be installed over a permanent effective vapor retarder, respecting current versions of the standard practice ASTM E1643 and the standard specification ASTM E1745. The vapor retarder must be placed directly underneath the concrete slab, above the granular fill, per Manufacturer’s instructions. The vapor retarder must have a perm rating of 0.1 or less and must have a minimum thickness of 10 mil (0.010 in).
C. No sealers or curing compounds are applied to or mixed into the concrete (refer to Section 03 05 00 – Common Work Results for Concrete of Division 3).
D. Installation of the resilient athletic flooring to be carried out no sooner than the specified curing time of the concrete (normal density concrete curing time is approximately 28 days for development of design strength, having a minimum 3500 psi or 25 MPa in compressive strength).

E. Substrate surface must be free of all contaminants that can inhibit bond (paint, wax, dust, oil or grease, sealer, curing compound, solvent, asphalt, old adhesive residues, etc.). All contaminants must be removed from the surface via mechanical abatement. Use of abatement chemicals is not recommended.

F. Concrete must have a smooth finish, proper density and be highly compacted with a tolerance of $1/8^{th}$ of an inch in a 10-foot radius (3.2 mm in 3.05 m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.

G. Moisture and alkalinity tests must be performed on all concrete substrates, under in-service conditions. It is recommended to turn on the HVAC unit prior to performing moisture testing, in order to ensure stable testing conditions and accurate results. The concrete's surface pH should be between 7 and 10. Relative humidity of the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F2170 (in situ probes). Moisture vapor emissions from the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F1869 (anhydrous calcium chloride).

H. Maintain stable room and substrate temperatures prior to moisture testing and flooring installation, during the flooring installation, as well as a minimum of 48 hours after the flooring has been completely installed. Recommended ambient temperature range is between $65^{O}F$ and $86^{O}F$ ($18^{O}C$ and $30^{O}C$) and recommended ambient humidity range is between 35% and 55%.

I. If installing over wood substrates, ensure exterior grade plywood with at least one good side, such as: APA (Engineered Wood Association) Exterior grade plywood (A-A Exterior, A-B Exterior or A-C Exterior) and CANPLY (Canadian Plywood Association) Exterior certified plywood (Canada: Grade G2S A-A or G1S A-C. USA: G2S A-A, A-B, B-B, or G1S A-C, B-C). There must be proper underfloor ventilation, plywood must be dry and should have a moisture content ranging between 6 and 12%, when measured with a quality wood moisture meter (electronic hygrometer).

J. Installation of resilient athletic flooring will not commence until the building is enclosed and all other trades have completed their work. It is the General Contractor or Construction Manager's responsibility to maintain a secure and clean working area before, during and after the installation of the resilient athletic flooring.

1.7 WARRANTY

A. The resilient athletic flooring is warranted to be free from manufacturing defects for a period of one (1) year from the date that is 30 days from shipment from the Manufacturer, per the terms and conditions of the Manufacturer's written Limited Warranty.

B. For standard applications, the resilient athletic flooring is warranted against excessive wear under normal usage for a period of ten (10) years from the date that is 30 days from shipment from the Manufacturer, per the terms and conditions of the Manufacturer's written Limited Warranty. For applications in ice arenas/ice skate use, the resilient athletic flooring is warranted against excessive wear under normal usage for a period of five (5) years from the date that is 30 days from shipment from the Manufacturer, per the terms and conditions of the Manufacturer's written Limited Warranty.

C. Refer to current copy of Manufacturer's written Limited Warranty for all terms and conditions, which shall be obtained directly from Manufacturer. In no event shall any warranties provided by any third parties (including distributors, insurance and/or private label providers) be considered a valid.

2 PART 2 – PRODUCTS

2.1 MANUFACTURED PRODUCT

2.1.1 Manufacturer

2.1.2

A. Mondo Luxembourg S.A.: Z.I. Foetz - Rue de l'Industrie, L-3895 Foetz, Luxembourg.
B. Or approved equal with matching quantities, finishes, accessories & warranties.

2.1.3 Description

A. Ramflex is prefabricated resilient athletic flooring, calendered and vulcanized with a base of natural and synthetic rubbers, stabilizing agents and pigmentation, as manufactured by Mondo Luxembourg S.A. or approved equal.
B. Dual durometer construction, vulcanized into a single prefabricated sheet/tile for optimal performance and durability. The Shore hardness of the top layer (wear layer) will be greater than that of the bottom layer (backing); Shore hardness of layers to be recommended by the Manufacturer and to respect limits specified.
C. Health-Conscious Production: Ramflex is free from red listed ingredients (LBC Red List) and is manufactured without bisphenol A (BPA), formaldehyde, halogens, heavy metals, isocyanates, phthalates and polyvinyl chloride (PVC).
D. Thickness: 0.236'' (10 mm).
E. Colors: Provided in standard, solid background colors with random marbleization throughout the wear layer's entire depth.
F. Surface Texture: Hammered.
G. Formats: Available in sheets that are 6'1" (1.86 m) wide and 42'7" (13 m) long [min. 19'8" (6 m)/max. 55'9" (17 m)]; available in tiles that are 36" x 36" (91.35 cm x 91.35 cm).

2.1.4 Performance

A. Performance of the Manufactured Product to conform to the following criteria:

Performance Criterion	Test Method	Requirement	Result*
Elongation at Break	ASTM D412	≥100%	≥180%
Tensile Strength	ASTM D412	≥300 psi	≥650 psi
Static Coefficient of Friction (neolite & leather	ASTM D2047	≥0.50 (dry)	≥0.80 (dry)
Hardness of Top Layer (Shore A)	ASTM D2240	75 ± 5	80
Hardness of Bottom Layer (Shore A)	ASTM D2240	60 ± 10	70
Abrasion Resistance (H18 wheel, 1000 g, 1000	ASTM D3389	≤1.0 g	≤0.4 g
Critical Radiant Flux	ASTM E648	>0.22 W/cm2 (Class	>0.45 W/cm2 (Class 1)
Reduction of Bacterial Activity - *MRSA (ATC*	ASTM E2180	-	≥99,99% reduction
Thickness	ASTM F386	10 mm (±0.2 mm) 0.236"	Compliant
Resistance to Chemicals	ASTM F925	≤Slight Change	Compliant **
Static Loading (Tested at 250psi)	ASTM F970	≤0.005 in	0.002 in
Heat Resistance	ASTM F1514	ΔE ≤8.0	Compliant
Light Resistance	ASTM F1515	ΔE ≤8.0	Compliant
Reduction of Bacterial Activity - *MRSA (ATC*	ISO 22196	-	≥99,999% reduction
Indoor Air Quality (IAQ) Certifications			
CA Section 01350	CA: V1.1-2010	-	Compliant
Greenguard Gold	Greenguard	-	Compliant
Greenguard Certification	Greenguard	-	Compliant

French Decree № 2011-321	ISO 16000-9	-	Compliant (Class A+)

*Results obtained from manufacturing controls can vary between production lots and do not constitute representations or warranties as to any particular production lot. Mondo reserves the right to modify product design and/or specifications at any time without notice.
**For complete list of chemicals tested, concentration and contact time, please communicate with Mondo's Technical Department.

2.1.5 Limitations

A. Do not install 10 mm Ramflex in areas that are subject to surface impacts, such as designated "free weight" sections in fitness facilities. For use in such areas, please refer to one of Mondo's recommended products for this type of application.

2.1.6 Materials

A. Provide Ramflex rubber flooring manufactured by Mondo Luxembourg S.A. or approved equal.
B. Provide Manufactured Product as specified in section 2.1.2 Description.

2.2 ACCESSORIES

A. Provide adhesive certified by Manufacturer: Mondo PU 105 (polyurethane) adhesive is recommended for installations over concrete. For suitability, recommendations and use, please refer to Manufacturer's current printed adhesive data sheets. In some cases, Mondo EP 55 (epoxy) may be used in areas that have not been specified for use of Mondo Everlay products, and that will not be subject to surface impacts or heavier dynamic loads (bleachers, equipment, etc.). For acceptable installations over wood or Mondo Everlay products (where surface impacts are not a concern), please consult Mondo's Technical Department for current adhesive recommendations.
B. Portland cement based patching or leveling compound to be supplied or recommended/approved by Manufacturer.

3 PART 3 – EXECUTION

3.1 INSTALLERS

A. Refer to section 1.4 of this document for information on installers.

3.2 EXAMINATION

A. Prior to resilient athletic flooring installation, ensure substrate is ready to receive resilient flooring and has been prepared according to Manufacturer's current substrate surface preparation guidelines. Refer to current version of ASTM F710 for additional information.
B. Ensure that concrete slabs, on or below grade, are installed over a permanent effective vapor retarder, respecting current versions of the standard practice ASTM E1643 and the standard specification ASTM E1745. The vapor retarder must be placed directly underneath the concrete slab, above the granular fill, per Manufacturer's instructions. The vapor retarder must have a perm rating of 0.1 or less and must have a minimum thickness of 10 mil (0.010 in).
C. Ensure that no concrete sealers or curing compounds have been applied to or mixed into the concrete (refer to Section 03 05 00 – Common Work Results for Concrete of Division 3).
D. Installation of the resilient athletic flooring to be carried out no sooner than the specified curing time of the concrete (normal density concrete curing time is approximately 28

days for development of design strength, having a minimum 3500 psi or 25 MPa in compressive strength).

E. Ensure that concrete surface is free of any contaminant that could inhibit bond (paint, wax, dust, oil or grease, sealer, curing compound, solvent, asphalt, old adhesive residues, etc.). All contaminants must be removed from the surface via mechanical abatement. Use of abatement chemicals is not recommended.

F. Confirm concrete has a smooth finish, proper density and is highly compacted with a tolerance of $1/8^{th}$ of an inch in a 10-foot radius (3.2 mm in a 3.05 m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.

G. Moisture and alkalinity tests must be performed on all concrete substrates, under in-service conditions. It is recommended to turn on the HVAC unit prior to performing moisture testing, in order to ensure stable testing conditions and accurate results. The concrete's surface pH should be between 7 and 10. Relative humidity of the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F2170 (in situ probes). Moisture vapor emissions from the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F1869 (anhydrous calcium chloride).

H. Ensure room and substrate temperatures are maintained prior to moisture testing and flooring installation, during the flooring installation, as well as a minimum of 48 hours after the flooring has been completely installed. Recommended ambient temperature range is between 65^{o}F and 86^{o}F (18^{o}C and 30^{o}C) and recommended ambient humidity range is between 35% and 55%.

I. If installing over wood substrates, ensure exterior grade plywood with at least one good side, such as: APA (Engineered Wood Association) Exterior grade plywood (A-A Exterior, A-B Exterior or A-C Exterior) and CANPLY (Canadian Plywood Association) Exterior certified plywood (Canada: Grade G2S A-A or G1S A-C. USA: G2S A-A, A-B, B-B, or G1S A-C, B-C). There must be proper underfloor ventilation, plywood must be dry and should have a moisture content ranging between 6 and 12%, when measured with a quality wood moisture meter (electronic hygrometer).

J. Installation of resilient athletic flooring will not commence until the building is enclosed and all other trades have completed their work. It is the General Contractor or Construction Manager's responsibility to ensure that a secure and clean working area is maintained before, during and after the installation of the resilient athletic flooring.

3.3 PREPARATION

A. Prepare substrate surface in accordance with Manufacturer's current printed guidelines.

3.4 INSTALLATION

A. Install tiles of resilient athletic flooring following Manufacturer's current printed guidelines.

B. Install all accessories following Manufacturer's current printed guidelines.

3.5 REPAIR

A. Refer to section 1.3.4 for extra stock materials. Repair material must come from the same original dye lot as the Manufactured Product initially installed.

B. Repairs are to be performed by Surfacing Contractor's qualified installers/technicians only.

3.6 CLEANING

A. Always wait at least a minimum of 72 hours after the resilient athletic flooring has been completely installed before performing initial maintenance. Always maintain the

resilient athletic flooring following Manufacturer's current printed guidelines.

3.7 PROTECTION

A. As needed, protect resilient athletic flooring with 1/8" Masonite during and after the installation, prior to its acceptance by the City.
B. Preserve the integrity of the installation and protect against direct sunlight/UV exposure; always ensure that windows and glass doors have inherent UV protection and/or are fitted with blinds/UV film.
C. Contractor to provide all windows and glass doors with UV protection and/or are fitted with blinds/UV film.

(Contractor to verify and provide as necessary)

END OF SECTION

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

A. Work of this Section as shown or specified shall be in accordance with the requirements of the Construction Documents Package.

1.2 WORK INCLUDED:

A. Work of this Section includes all labor, materials, equipment and services necessary to complete epoxy flooring incorporating ceramic-coated, colored, inorganic quartz aggregate, waterproofing membrane, and integral base as specified herein.

1.3 RELATED WORK:

A. Cast in Place Concrete - Section 03300
B. Floor drains – See plumbing drawings

1.4 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Product Data: Submit manufacturer's technical data application instructions and general recommendations for decorative quartz epoxy flooring and waterproofing membrane specified herein.
C. FGBC Submittal: Florida Green Building Coalition (min. silver rating)
D. General Contractor shall submit material selection board with trim, patterns, selected colors, etc.
E. Samples for initial selection purposes in form of manufacturer's color charts showing range of standard colors available.
   1. Submit 2-1/2" x 4" samples in color and quartz aggregate combination as selected.
   2. Material certificates signed by manufacturer certifying that the decorative quartz epoxy flooring submitted complies with requirements specified herein.
   3. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.

1.5 QUALITY ASSURANCE:

A. Installer Qualifications: Engage an experienced installer or applicator that has specialized in installing resinous flooring types similar to that required for this Project and who is acceptable to manufacturer of primary materials.

B. Single-Source Responsibility: Obtain epoxy component of flooring materials, including primers, resins, hardening agents, and finish or sealing coats, from a single manufacturer. Obtain ceramic coated quartz aggregate from primary manufacturer of that product.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels containing brand name and directions for storage and mixing with other components.

B. Store materials to comply with manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.7 PROJECT CONDITIONS:

A. Environmental Conditions: Comply with epoxy resin composition flooring manufacturer's directions for maintenance of ambient and substrate temperature, moisture, humidity, ventilation, and other conditions required to execute and protect work.

B. Lighting: Permanent lighting will be in place and working before installing decorative quartz Epoxy flooring.

1.8 WARRANTY:

A. Flooring shall be fully warranted for a minimum of Five (5) years from substantial completion for any defect or failure, including delamination, pealing, caulking, cracking, fading, discoloring, etc. Warranty shall include material and labor required to repair or replace floor, as necessary.

PART 2 – PRODUCTS

2.1 MATERIALS: Decorative quartz epoxy flooring shall be:

Dex-O-Tex Decor-Floor decorative seamless flooring system as manufactured by

Crossfield Products, Corp.

3000 E. Harcourt St.

Rancho Dominguez, CA 90221

Tel: 310-886-9100, Fax: 310-886-9119

PolyGuard Resinous Flooring Gem Stone Quartz decorative seamless flooring system as manufactured by

Delta Polymers, Inc.

130 South 2nd Street

North Bay Shore, NY 11706

(800) 966 5142, Fax (631) 595-2537

DUR-A-QUARTZ multiple component, decorative seamless flooring system as manufactured by

Dur-A-Flex, Inc.

95 Goodwin St.

East Hartford, CT 06108
1-800-253-3539, Fax (860) 528-2802

2.2 PROPERTIES:

A. Colors: As indicated, or if not otherwise indicated, as selected by Design Team Consultant from manufacturer's standard color combinations.

B. Physical Properties: Provide flooring system that meets or exceeds the listed minimum physical property requirements when tested according to the referenced standard test method in parentheses.

	Durometer "D" 85
Compressive Strength *345 psi (100% failure in concrete)* Complete System (ASTM C-109) *8,556 psi* Resin Component (ASTM D-695) *12,900 psi*	Aggregate Hardness (Moh's Mineral Scale) *6-1/2 - 7*
Surface Hardness (ASTM D-2240)	Indentation Characteristics (MIL-D-3134), Para. 4.7.4.2.1 (Steadily Applied Load)

0.005 indentation

Impact Resistance
(MIL-D-3134), Para. 4.7.3
0.011 indentation
No cracking, loss of bond

Water Absorption
(MIL-D-3134)
Less than 1%

Abrasion Resistance
(ASTM C-501, H-22 Wheel)
19 Wear Index

Tensile Strength
(ASTM D-638)
Resin Component
4,400 psi

Elongation
(ASTM D-638)
Resin Component
19.6%

2.3 SUPPLEMENTAL MATERIALS:

A. Not used.

B. Anti-Microbial Additive: Incorporate antimicrobial chemical additive to control growth of most bacteria, fungi, algae and actinomycetes.

PART 3 – EXECUTION

3.1 INSPECTION:

A. Examine the areas and conditions where decorative quartz epoxy flooring is to be installed and notify the Design Team of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the General Contractor in conformance with the specifications.

3.2 PREPARATION:

A. Substrate: Perform preparation and cleaning procedures according to flooring manufacturer's instructions for particular substrate conditions involved, and as specified. Provide clean, dry, and neutral substrate for flooring Application.

B. Concrete Surfaces: Shot-blast, acid etch, or power scarify as required to obtain optimum bond of flooring to concrete. Remove sufficient material to provide a sound surface free of laitance, glaef florescence, and any bond-inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminates. Repair damaged and deteriorated concrete to acceptable condition. Leave surface free of dust, dirt, laitance, and efflorescence.

C. Not used.

D. Materials: Mix epoxy resin components when required and prepare materials according to flooring system manufacturer's instructions.

3.3 APPLICATION:

A. General: Apply each component of decorative quartz epoxy flooring system according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated.

B. Broadcast Coats: Apply liberal application of clear epoxy resin mixture, allow to self-level, broadcast (by hand or spray machine) ceramic-coated quartz aggregate, allow to set to hardness, sweep off excess unbonded aggregate and repeat process to achieve minimum thickness of 3/16".

Build up from low point to perimeter walls at slope not less than shown on construction documents.

C. Finish or Sealing Coats: After quartz-filled broadcast coats have cured sufficiently, apply finish coats of type recommended by flooring manufacturer to produce finish matching approved submittal sample and in number of coats and spreading rates recommended by manufacturer.

D. Finished floor shall be minimum 3/16" thick, uniform in color and free of trowel marks.

E. Cove Base: Apply cove base mix to wall surfaces at locations shown to form cove base height of 6 inches unless otherwise indicated. Follow manufacturer's printed instructions and details including taping, mixing, priming, troweling, sanding, and top-coating of cove base.

3.4 CURING, PROTECTION AND CLEANING:

A. Cure decorative quartz epoxy flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.

END OF SECTION

SECTION 096766 - POLYURETHANE FLOOR SYSTEM

Part 1-GENERAL

1.01 DESCRIPTION

A. Scope
   1. The complete installation of polyurethane surfacing over high-performance resilient base mat, including adhesives, resilient base mat, polyurethane sealer, polyurethane structure layer, surface topcoat, and court markings.

B. Related work specified under other sections.
   1. Section 033000 - Cast in place concrete.
      a. Concrete Slab Depression: a total of 9 mm, equal to system thickness, (0.3543 inches).
      b. Surface Finish: steel troweled and finished smooth.
      c. Concrete Tolerance: 1/8" (3mm) in radius of 10' (3m). Floor Flatness and Floor Levelness (FF and FL) numbers are not recognized.
      d. NO CURING AGENTS OR SEALERS ARE TO BE APPLIED TO THE CONCRETE SLAB.
   2. Section 071300 – Sheet Waterproofing.
      a. Concrete subfloors on or below grade shall be adequately waterproofed beneath the slab and at the perimeter walls and on the earth side of below grade walls by general contractor using suitable type membrane.
      b. Sand-Poly-Sand slab construction is not an acceptable construction.

1.02 QUALITY ASSURANCE

A. Floor System Supplier Qualifications

   1. Supplier shall be an established firm experienced in field and have been in business for a minimum of ten (10) years, Robbins, Inc., or approved equals below, provided that ALL system materials and performance criteria are met and that all liquid components come from a single-source formulator:
      a. Herculan Blue 33 (with color-matched resin)
      b. Conipur HG 7+2 (with color-matched resin)
      c. No other products/suppliers will be accepted.
   2. Formulator shall be ISO-9001 certified for quality control, and ISO-14001 certified for environmental care, and provide copy of Certification document upon request.

B. Floor Contractor/Installer Qualifications and Certifications
   1. Floor Contracting Company and field personnel shall be trained by supplier on proper installation and finishing process.

C. System Industry Approvals
   1. Floor system shall be approved by F.I.B.A. (International Basketball Federation) and provide copy of Approval upon request.
   2. Floor system shall be approved by I.H.F. (International Handball Federation) and provide copy of Approval upon request.

D. System Technical Data:

Technical Data			
Character	Point-elastic		
Classification	n/a		
Nominal thickness	9 mm	(0.3543 inches)	
Shock Absorption	28%		ASTM F2772
Vertical Deformation	1.0 mm		ASTM F2772
Linear Friction	81		ASTM F2772
Ball Bounce	99 %		ASTM F2772
Gloss	3%-7%		EN 2813
Resistance to rolling load	≥1500 N		EN 1569
Resistance to impact	≥800 gr @ 10°C		EN 1517
	≥1200 gr @ 17°C		EN 1517
Resistance to indentation	0.35 mm @ 5 min		EN 1516
	0.15 mm @ 24 hrs		EN 1516
Resistance to wear	150 mg		EN ISO 2813
Flammability	Bfl-S1		EN 13501-1
V.O.C. content - Adhesive	Solvent free		
V.O.C. content - Topcoat	0.01 gr/lit (EU)		2004/42/EG
	45 gr/lit (US)		ASTM D 3960
Adhesive composition	Free of solvents and heavy metals		
Resin composition	Free of solvents and heavy metals		
Elongation at break - Structure	150%		DIN 53455
Tensile Strength - Structure	8 N/mm2	(1,160 psi)	DIN 53455
Tear Strength - Structure	25 N/mm	(142 pli)	DIN 53455
Colour fastness	8 (excellent)		DIN 54004

1.03 SUBMITTALS

A. Manufacturer's Product Data
   1. Submit three (3) Robbins Pulastic Academy 90 Floor System specification sheets.
B. Concrete Guidelines
   1. Submit three (3) copies of Recommendations for correct preparation, finishing and testing of concrete subfloor surfaces to receive granulated base mat and polyurethane floor system.
C. Samples
   1. Submit one (1) sample of Pulastic Academy 90
   2. Submit one (1) Pulastic Topcoat Standard Color Chart
   3. Submit one (1) Pulastic Line paint Color Chart
D. Maintenance Literature
   1. Submit copy of Pulastic Maintenance Instructions.
E. References
   1. Submit Letter attesting that Floor Contractor and Field Personnel have been properly trained to perform work per specifications and contract.
   2. Reference list of three individual for whom installer has worked on projects of similar size and magnitude.

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials
   1. Material shall not be delivered or installed until all masonry, painting, plastering, tile work, marble and terrazzo work are completed and all overhead mechanical work, lighting, backstops, scoreboards are installed. Room temperature shall be at least 55 degrees Fahrenheit, and ambient relative humidity shall be 80% or less. In slab relative humidity 85% or less per ASTM F-2170 with moisture 4% by mass or less on concrete, using a moisture impedance meter (Tramex®) or equivalent per ASTM E-1907. Contact Robbins Technical Support if numbers exceed recommendations (800-543-1913)

2. Area where materials are to be stored should be maintained at 55 degrees Fahrenheit and under 75% relative humidity by the General Contractor.

1.05 JOB CONDITIONS-SEQUENCY

A. Do not install floor system until concrete has been cured 60 days and the requirements in paragraphs 1.01 and 1.04 are obtained.
B. General Contractor is responsible to ensure slab is clean and free of all dirt and debris prior to floor installation beginning.
C. Permanent heat, light and ventilation shall be installed and operating during and after installation. Environmental temperatures must average a minimum of 65 degrees Fahrenheit for one full week proceeding, throughout, and 72 hours following application.
D. After floors are finished, area to be kept locked by general contractor to allow curing time for the paint and finish system(s). No other trades are to be allowed on floor until it is accepted in writing by owner or owner's authorized agent.

1.06 GUARANTEE

A. Guarantee shall not cover damage caused in whole or in part by casualty, ordinary wear and tear, abuse, use for which material is not designed, faulty construction of the building, settlement of the building walls, failure of the other contractors to adhere to specifications, separation of the concrete slab and excessive dryness or excessive moisture from humidity, spillage, migration through the slab or wall, or any other source.
B. Robbins, Inc. hereby warrants the Pulastic Academy 90 material to be free from manufacturing defects for a period of 25 years. This warranty is in lieu of all other warranties, expressed or implied including but not limited to any warranty of merchantability or fitness for a particular purpose, and of any other obligations on the part of Robbins. In the event of breach of any warranty, the liability of Robbins shall be limited to repairing or replacing Pulastic Academy 90 material and system components supplied by Robbins and proven to be defective in manufacture, and shall not include any other damages, either direct or consequential.

Part 2 - PRODUCTS

2.01 MATERIALS

A. Robbins PULASTIC or approved equal.
   1. Adhesive
      a. Pulastic Tacly Adhesive: a two-component polyurethane adhesive.
   2. Shock Pad
      a. Academy Shock Pad, a granulated rubber/polyurethane/foam mat 7.0 mm thick; standard shock pad that does not contain foam will not be accepted.
   3. Pad Sealer
      a. Pulastic EG Sealer: a two-component polyurethane sealer.
   4. Polyurethane Resin
      a. Pulastic GM1500 Compound: a two-component polyurethane resin pigmented to color-match the surface topcoat. Neutral or standard gray resins not color-matched to the topcoat color will not be accepted.
   5. Surface Coating
      a. Pulastic Coating Multi-Coat: a pigmented, two-component, water-dispersed polyurethane surface coating.
         1) Color Options: Specify Topcoat color from following standard colors:
            205 Sand Beige; 504 Stone Grey; 401 Lime Green; 417 May Green; 400 Green Oxide; 407 Turquoise Mint; 800 Yellow Ochre; 106 Autumn Brown; 100 Red Oxide; 307 Pastel Blue; 308 Pigeon Blue; 306 Steel Blue; 305 Sky Blue; 309 Capri Blue; 506 Dusty Grey; 507 Iron Grey

2) Optional designer colors available.

6. Game line Paint
   a. Pulastic Line paint W: a pigmented, two-component, water-dispersed polyurethane paint.
      1) Color Options: Specify Black, White, Blue, Red, Yellow
      2) Non-Standard Options: Light Grey; Dark Blue; Dark Green; Pastel Orange.

Part 3 - EXECUTION

3.01 INSPECTION

A. Inspect concrete slab for proper levelness tolerance, dryness, and contamination, (see Part 1 –Sec 1.01 and Sec. 1.04) and report any discrepancies to the general contractor and architect in writing.
B. All work required to put the concrete subfloors in acceptable condition shall be the responsibility of the general contractor.
C. Subfloor shall be broom cleaned by general contractor.
D. General Contractor will notify the flooring installation company to proceed with the installation after concrete slab specifications are met.
E. Installer shall perform tests for moisture and adhesion prior to application and report adverse conditions to the general contractor in writing.
F. Installer shall document all working conditions provided in General Specifications prior to commencement of installation.

3.02 INSTALLATION

A. Robbins Pulastic
   1. Shock Pad
      a. Mix two-component Tacly Adhesive according to supplier’s instructions and spread adhesive using ROBBINS PULASTIC notched trowel.
      b. Unroll polyurethane/rubber granulated base mat into freshly applied adhesive. Seams shall be in virtual contact with absence of compression fit. Roll surface of base mat with a medium-size roller.
   2. Sealer
      a. Mix two-component EG Sealer according to supplier's instructions and spread sealer over base mat using a straight trowel. Allow to cure minimum 12 hours before proceeding.
   3. Structure Layer
      a. Mix two-component ROBBINS PULASTIC GM1500 pigmented polyurethane resin and apply at proper thickness according to supplier's instructions. Allow to cure minimum 12 hours before proceeding.
   4. Surface Coating
      a. Mix two-component ROBBINS PULASTIC Coating Multi-Coat and apply using ROBBINS PULASTIC lambswool roller(s) according to suppliers’ instructions. Allow 24 to 48 hours curing time before proceeding.
   5. Game lines
      a. Mix two-component ROBBINS PULASTIC PU-Line paint W according to supplier's instructions.
      b. Line painting should be in accordance with supplier's directions.
      c. Color of court markings shall be chosen from ROBBINS PULASTIC PU-Line paint standard colors.
      d. Consult architectural drawings for game line locations and chosen colors.
B. Perimeter Molding (Optional):
   1. Install a rubber base, anchored to the walls with standard base cement.

3.03 CLEANING

A. Clean up all unsend materials and debris and remove from the premises. Dispose of empty containers in accordance with federal and local regulations.

3.04 PROTECTION

A. Cure Time
   1. No traffic or other trades shall be allowed on the surface for a period of one week following completion to allow for complete and proper cure of the finish.
B. Other Trades
   1. It shall be the responsibility of the general contractor to protect the surface from damage by other trades before acceptance by the owner or the owner's authorized agent.
C. Safety.
   1. No smoking, open flames or sparks from electrical equipment or any other source shall be permitted during the installation process, or in areas where materials are stored.

END OF SECTION

SECTION 096813 – TILE CARPETING

PART 1 - GENERAL

1.01 SUMMARY DEFINITION

A. Modular tile carpeting for use in facilities shall be a high-performance, branded 100% Type 6 or 6,6 nylon. Mill extruded nylons will not be accepted. Carpet shall be tufted and have a manufacturer's PVC-free cushion backing system which provides a non-permanent installation application, using a nonreactive or high moisture, releasable adhesive, meeting or exceeding requirements for certification according to the CRI Green Label Plus IAQ Test Program. Carpet tile shall be recyclable meeting USGBC FGBC Rating System requirements and shall have third party certification..

1.02 APPLICAION

a. Industry Standards and Tests:

A. This Design Criteria shall be used in determining and specifying tile carpeting, LVT and entry system at all facilities. It is intended to be an all-inclusive specification in and of itself, in that, it is specifying tools such as MasterSpec. All products must meet or exceed design intent specification.

1. Americans with Disabilities Act (ADA): Section 4.5.3. Accessibility Guidelines for Building & Facilities
2. American Association of Textile Chemists and Colors (AATCC): 16, Option E Colorfastness of Light; 165 Colorfastness to Crocking, Carpets AATCC Crock Meter Method.
3. Aachener Test: Dimensional Stability (DIN Standard 54318 175 Stain Resistance; Pile Floor Covering
4. American Society for Testing and Materials (ASTM) D 2859 Flammability of Finished Textile Floor Covering Materials. E 648 Critical Radiant Flux of Floor Covering System Using a Radiant Heat Energy Source (NFPA 253) E662 Specific Optical Density of Smoke Generated by Solid Materials (NFPA 258)
5. Consumer Product Safety Commission (CPSC): FF-1-7 Methenamine Pill Test.D.Within 10 days after joint review, submit complete schedule.

1.03 SELECTION CRITERIAS

A. Industry Standards and Tests:

6. Consumer Product Safety Commission (CPSC): FF-1-7 Methenamine Pill Test.D.Within 10 days after joint review, submit complete schedule.

B. Sustainable Compliance: Preference goes to carpet tile manufacturers who operate a carpet tile-recycling program for 100% of the carpet product (at the end of its useful life). Third party certification shall be required.

1. NSF/ANSI-140 Platinum: All carpet products installed shall be certified to meet the
2. NSF/ANSI-140 Platinum: All carpet products installed shall be certified to meet the NSF/ANSI-140 standard at the Platinum certification level.
3. For carpet tile, documentation indicating compliance with testing and product requirements of CRI's "Green Label Plus" program.
4. Carpet must be free from LBC Red List ingredients at 100 ppm;
5. Red List Free must be 3rd party verified and publicly available through LBC Declare Labels;

1.04 SUBMITTALS

A. Scheduler: CONTRACTOR's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of requested.

1.05 SUBSTITUTIONS

A. Drawings and Product Data Sheets: Submit for all products proposed for use, describing physical characteristics, sizes, patterns, colors available, type of subfloor, and method of installation.

B. Test Reports: Provide certified test reports, prepared by an independent testing laboratory, showing conformance to specified performance standards. Test results shall represent average results for production goods, and shall not be over two years old.

C. Samples: Full size samples shall be required for each type of tile carpeting specified.

D. Maintenance Data: Submit manufacturers recommend cleaning and maintenance data. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

E. Recycled Content Percentage Submittals.

1. Submit a statement signed by the manufacturer’s Executive Officer or independent certification third-party that the provided carpet materials have the specified recycled material percentage.

F. Shop Drawings and Product Data Sheets: Submit for all products proposed for use, describing physical characteristics, sizes, patterns, colors available, type of subfloor, and method of installation.

G. Test Reports: Provide certified test reports, prepared by an independent testing laboratory, showing conformance to specified performance standards. Test results shall represent average results for production goods, and shall not be over two years old.

H. Samples: Full size samples shall be required for each type of tile carpeting specified.

I. Maintenance Data: Submit manufacturers recommend cleaning and maintenance data. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

J. Recycled Content Percentage Submittals

1. Submit a statement signed by the manufacturer’s Executive Officer or independent certification third-party that the provided carpet materials have the specified recycled material percentage.

K. Existing Carpet Recycling Plan and Recycling Certification

1. Submit documentation describing the reclamation plan for existing carpet. Include appropriate contact information, overview of procedures, and limitations and conditions - applicable to the project Carpet recycling options consist of:
    a. Repurposing - reusing the product in another application such as facilitating the donation of used carpeting to charities and other nonprofit organizations.

b. Closed Loop Recycling - turning waste materials into new materials of the same value, such as vinyl backing into vinyl backing and nylon yarn into nylon carpet yarn.
c. Open Loop Recycling – creating other product types from reclaimed carpet. For example, turning nylon face fiber into automotive parts or carpet padding, including nylon face fiber in recycled backings
d. Waste-to-Energy - using carpet for waste-to-energy. In the case of waste-to-energy, manufacturer shall justify why carpet cannot be recycled as this method should be a last resort.
e. Landfill or incineration – are not approved disposal methods.

2. At the completion of the project, a certificate shall be furnished verifying the reclamation of the carpet and the pounds of material diverted from the landfill.

1.05 QUALITY ASSURANCE

A. Contractor Qualifications:Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and accessories on similar projects for a minimum of five (5) years, acceptable to the carpet tile manufacturer in writing to Owner/Design firm.

1. Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and accessories on similar projects for a minimum of five (5) years, acceptable to the carpet tile manufacturer in writing to Owner/Design firm.

2. Installer shall have documented experience with a formal lift system when applicable to the job.

B. Manufacturer(s) Qualifications :

1. Utilize only manufacturers making the specified materials as a current and regular production item.

2. Manufacturer: Company specializing in carpet tile manufacturing with a minimum of ten continuous years of documented experience. Carpet manufacturing processes must be certified by a recognized ISO registrar to the current requirements of either the ISO 9001 or ISO 9002 standards for quality management systems as established by the International Organization for Standardization (1987), revised 1994).

3. Manufacturer to provide the three (3) references of installations in similar facilities.

C. Quality and Performance Testing: Carpet shall comply with the following performance testing requirements.

1. CRI TARR Rating: “Severe” or “Heavy” using ASTM D-5252 Hexapod Tumble Test. Value must be 3.0 or higher to ensure appearance retention in high traffic areas such as school classrooms (rating of 3.0) and corridors (rating of 3.0 – 3.5).
2. Noise Reduction Coefficient, ASTM C423: 0.20 minimum. 0.25 for LEED facility
3. ASTM D 2859 or CPSC FF-1-70 Methenamine Pill Test: Pass.
4. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm Consumer Product Safety Commission (CPSC): FF-1-7 Methenamine Pill Test.D.Within 10 days after joint review, submit complete schedule.
5. Dry Breaking Strength: Not less than 100 lbf according to ASTM D 2646.
6. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
7. Dimensional Stability: 0.2% or less according to ISO 2551 (Aachen Test).
8. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
9. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

10. ASTME 648, Critical Radiant Panel Flux Class I, not less than 0.45 watts per square centimeter.
11. AATCC 16, Option E: Minimum rating of 4 on grey scale after 80 hours exposure.
12. ASTM E 662 (NFPA 258): Smoke density less than 450 optical density.
13. AATCC 165: Minimum rating of 4 wet and dry.
14. AACHEN Test (DIN Standard 54318): Dimensional stability 0.2% shrinkage or growth.

1.06 DELIVERY, STORAGE, HANDLING

A. Comply with CRI 104 Section 5 Storage and Handling.
1. Deliver all material to the installation site in the manufacturer's original packaging. Packaging shall contain manufacturer's name, product color and pattern name, identification number, and other related information.
2. Carpet tiles shall be stored between 40° F and 100° F and shall be conditioned to between 60° F and 90° F for 48 hours prior to installation.FF-1-70 Methenamine Pill Test: Pass.

1.07 PROJECT SITE AN CONDITIONS

A. Field Conditions
1. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.
2. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weather tight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants.
3. Floor temperature should be 60 °F minimum for proper adhesive curing and performance.
4. If subfloor is contaminated with an oily residue either from removal of "cutback" during asbestos abatement or from a previous end use such as metal fabrication, this residue MUST be totally removed or covered prior to applying modular adhesive and carpet.
5. Product is allowed to be installed over moisture stained concrete. Products not allowed to be installed over moisture stained concrete must be noted.
6. Where demountable partitions or other items are indicated for installation on top of carpet
7. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.
8. Requisite field conditions for Milliken Non-Reactive Standard Adhesive.
9. If there is no vapor retarder or the presence of a vapor barrier is unknown for On Grade renovations, product may be installed if the moisture levels do not exceed 95% relative humidity as measured by the in situ relative humidity probe test per the latest edition of ASTM F2170, as described in the Milliken Non-Reactive Standard Adhesive product specifications and Milliken's then current published instructions for installation of modular carpet.
10. No moisture testing is required for Above Grade renovations provided:
    a. No visible water on the surface
    b. Acclimatized to service conditions.
    c. Floor prep must be performed in accordance with ASTM F 710-11 unless specifically allowed per manufacturer's installation instructions.
    d. All topical compounds must be removed prior to application of adhesive.
    e. Bond test is required with archived written and photo documentation, including any corrective action required.

11. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

B. Special Warranty for Milliken Non-Reactive Standard Adhesive: Manufacturer warrants that the Milliken Non-Reactive Standard Adhesive, when used with current Milliken modular carpet with WellBAC™ Comfort Plus or WellBAC™ Comfort backing systems, will form a bond that provides tack and resistance to lateral movement while allowing for the removal of the modular carpet in high moisture slab conditions with no limit on relative humidity as long as there is no visible water on the slab surface for the Lifetime of the original carpet installation in Commercial installations subject to meeting the following conditions:

1. No moisture testing is required for On Grade renovations provided:
2. If there is no vapor retarder or the presence of a vapor barrier is unknown, product may be installed if testing is done per the latest edition of ASTM F2170, as described in the Milliken Non-Reactive Standard Adhesive product specifications and Milliken's then current published instructions for installation of modular carpet, and the moisture levels do not exceed 95% relative humidity as measured by the in situ relative humidity probe test.
3. If the concrete slab is experiencing hydrostatic pressure, or the slab surface is visibly wet, the slab should be treated by some other method and is not covered by this warranty.
4. Milliken does not warrant against hydrostatic pressure, instances where water is forcibly pushed into the slab and/or moisture events caused by broken pipes. In such cases the warranty will be voided.

C. Warranty Period: Lifetime

1. Lifetime" is defined as the period of time that the original purchaser of the original carpet installed with the adhesive product chooses to keep the carpet on the floor at the original installation site. Lifetime warranties only apply to adhesive product purchased after November 4, 2016.

D. Validation

1. The warranty only applies to use of the Milliken Non-Reactive Standard Adhesive product in carpet installations when bond testing, substrate preparation, adhesive application and carpet installation have all be performed in accordance with the requirements and instructions set forth on the product label, the product specification sheet, Milliken's then current published instructions for installation of modular carpet (hich are specific for each carpet product), and the then current Carpet and Rug Institute publication CRI 104 (collectively, the "Documentation"). Furthermore, the carpet installation must be in an indoor commercial environment. The warranty shall not apply to:
    a. Installations on substrates that were not prepared as instructed in the Documentation;
    b. Installations where silicates or other sealers or curing additives have been used on the substrate;
    c. Installations where silicates or other sealers or curing additives have been used on the substrate;
    d. Installations over substrates where hydrostatic pressure exists;
    e. When the claimant does not have written and photographic documentation of the bond testing conducted prior to the installation;
    f. Installation failures due to outside sources of water;
    g. Installations taken up or replaced prior to inspection by authorized Milliken personnel;
    h. Installations with chemically cleaned substrates, where improper cleaning methods have been used, or where adhesive removed have been applied;
    i. Installations using incompatible curing compounds, mold release agents, or non-Portland cement based leveling or patch compounds;
    j. Failure of leveling or patch compounds of any kind;
    k. Damage caused by expansion joints or other structural areas;

l. Structural failure, seismic action, discoloration, caustic solutions entering the system topically through joints;
m. Where the adhesive product was allowed to freeze prior to use. In no event shall Milliken be liable for incidental or consequential damages, whether in contract, warranty, negligence, strict liability, or otherwise.

E. Examination
1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and installation tolerances.
2. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and installation tolerances
3. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 “Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits
   a. All topical membrane forming concrete curing compounds must be removed.
   b. Concrete subfloor must be structurally sound, clean, smooth, trowel finish (not burnished) and level. Cracks and holes in excess of 1/8" (3.2mm) should be filled with a Portland Cement based floor patching material such as W.W. Henry 547 Unipro™, DAP “Webcrete 98”, Maipei “PlaniPatch”, Ardex “Featherfinish” or similar. Gypsum based compounds are not recommended.
   c. The only physical requirement for existing adhesive films is that they be scraped clean and dry. If additional smoothing is required and residual adhesive is black (cutback or asphalt emulsion) smoothing must be accomplished by applying a very thin layer of one of the above patching compounds.
   d. If residual adhesive is not black, scrape or sand until smooth and non-tacky as required.
   e. Protruding objects must be removed. Floor must be flat (not undulating) to within 1/4" in 12' (6.4mm across 3.66m) with no abrupt changes.
   f. When the claimant does not have written and photographic documentation of the bond testing conducted prior to the installation; Failure to do so will result in an unacceptable installation. Gyplock Sealer by Cornerstone Coatings International Inc. is a suitable sealant.

F. Preparation
1. Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions.
2. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
3. Broom and vacuum clean substrates to be covered immediately before installing carpet.

G. Installation:
1. Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.

2. Installation Method: As recommended in writing by carpet tile manufacturer.
3. Maintain dye-lot integrity. Do not mix dye lots in same area.
4. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
5. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
6. Coverage rates for WellBAC™ Comfort Plus and WellBAC™ Comfort cushion back full spread for all tile sizes: 35-40 sq. yards per gallon (9.5-10 sq. meters per liter).
7. In extreme environments, such as casinos and convention centers, which will routinely experience rolling loads in excess of 5,000 lbs., a heavier full spread of adhesive is recommended. Target coverage for this end use is 20-25 sq. yards per gallon (5-6 sq. meters per liter) for the Non-Reactive Standard product.
8. Adhesive Readiness should be verified as follows before beginning installation.
    a. A bond test is a mock-up installation done prior to the general installation of the Modular Carpet tile to indicate whether the adhesive will bond satisfactorily to the substrate and floor covering. Bond testing will aid in identifying both the working characteristics of the adhesive, such as the appropriate open and working time for the site conditions, and also any potential bonding problems to the substrate.

H. Bond Test Procedure:.
1. Select an approximately 7-foot square area (4 square meters) in a typical location on the substrate or slab. The floor should be prepped and consistent with the installation plan per Milliken Modular carpet installation instructions.
2. Milliken modular carpet adhesives should be applied to the substrate for a releasable installation in the recommended manner (trowel, roller, or aerosol spray) and application rate. The adhesive should be allowed to dry completely prior to installation of modular carpet.

3. Observe the adhesive drying time, which will vary with the floor porosity and ambient conditions. Properly dried adhesive will not transfer to the finger and will have a tacky feel.

4. After placing the carpet tile on the dried adhesive apply downward pressure to assure contact with the substrate. Tiles should be immediately locked in place inhibiting lateral movement.

5. After 24 hours, observe the mock-up installation to see if any obvious problems may exist. The modular carpet should be adequately bonded to the substrate, and inhibit lateral movement with adhesive remaining firmly bonded to the substrate. To test this attempt to slide each tile. Now lift each carpet tile and check backing for adhesive transfer. All adhesive should remain on the floor. There should be no adhesive transfer to the back of the tile.

6. Document with photos that show floor prep, floor with adhesive, and back of tile upon tile removal after 24hr period.

7. Testing should be conducted approximately 72 hrs. prior to installation.

8. If installation covers multiple floors a bond test should be conducted on grade.

I. Protection.
1. Perform the following operations immediately after installing carpet tile:
    a. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.

b. Remove yarns that protrude from carpet tile surface.
c. Vacuum carpet tile using commercial machine with face-beater element.
d. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations." Do not use plastic, adhesive sheet.

1.08 WARRANTY

J. Project warranty shall be as stated in Division 01 of the Specifications.

K. Special Tile Carpeting Warranty: Written warranty, non-prorated, signed by carpet tile manufacturer agreeing to remove and replace tile carpeting installation that fails in materials and workmanship within the specified warranty period.

L. Provide certified copies of the following manufacturer's product warranties.
1. Lifetime Face Fiber Wear
2. Lifetime Staining/Soiling Resistance
3. Lifetime Color Pattern Permanency
4. Lifetime Delamination of Backing
5. Lifetime Edge Ravel
6. Lifetime Tuft Bind
7. Lifetime Floor Compatibility
8. Lifetime Antistatic
9. Lifetime Flammability
10. Lifetime Cushion Resiliency
11. Lifetime Dimensional Stability
12. Lifetime Floor Release
13. Lifetime Moisture Resistance

M. Warranty shall be sole source responsibility of the manufacture. Second source warranties or warranties that involve parties' other than the manufacturer is unacceptable.

N. In case of multiple buildings where tile carpeting has been used, identify building name/number and pattern, pattern color, square yards used.

O. Installers Warranty: The Contractor shall fully guarantee the installation against defects in workmanship, seaming and loss of adhesion to floor for a period of one (1) year from the date of Substantial Completion. Upon written notice, the Installer shall repair or replace the affected area at no cost.

1.09 EXTRA MATERIALS

P. Provide additional carpet tiles equal to 3% of each type, color and pattern furnished for use as maintenance stock.

PART 2 - PRODUCTS

2.01 MANUFACTURESRS

A. All carpet tiles shall be products of one manufacturer, unless specifically indicated otherwise.

B. Shall be pre-approved by owner/owners 10 days prior to bid date

C. Manufacturer shall be currently involved in reuse technology including renewing and repatterning used product to eliminate waste sent to landfills.

D. Carpet shall conform to the CRI Indoor Air Quality Testing Program with specific product certification number. Manufacturer shall have a stated environmental policy and documented waste generation improvements.

2.02 CARPET TILE COMPONENT CHARACTERISTICS (MINIMUM)

A. Manufacturer: Milliken

B. Product: Major Frequency 3- Boost IPR161-141-19

C. Construction: Tufted, Textured Loop

D. Fiber Content: 100% nylon Type 6 or 6,6

E. Fiber Type:

F. Dye Method: Digital or Solution dyed technology

G. Color and Pattern: Selected by Architect and approved by Owner.

H. Pile Density: 5400 minimums.

I. Gauge: 1/12" minimum.

J. Surface Pile Weight: 14 oz./sq. yd. minimum.

K. Stitches per Inch: 8.00" minimum.

L. Backing System: Manufacturer's standard PVC-Free open cell polyurethane cushion backing

M. Critical Radiant Flux Classification: Not less than 0.45 W/sq.cm.

N. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC-165, per AATCC-165.

O. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) per AATCC-16..

P. Sh Stain Resistance: AATCC-175, must pass Acid Red 40 spot test with an 8 or better.

Q. TARR Rating: Severe Traffic End-Use Applications

R. Dimensional Stability: Aachen Method Din 54318, 0.2% or less per ISO 2551.

S. Smoke Density: < or = 450 flaming.

T. Static Generation: AATCC 134 w/neolite < or = 3.5KV at 20% r.h.

U. Flame-Spread and Flammability:

V. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement based formulation provided by carpet tile manufacturer.

W. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and recommended by carpet tile manufacturer for releasable installations.

X. Indoor Air Quality Control: Carpet tile and adhesive shall be CRI Green Label Plus certified by published class (product type) and certification number.

Y. Water intake for Manufacturing and Finishing purposes must not exceed 1 gallon per square meter.

Z. Embodied Carbon 12.31 (kg CO2 e)/m.

2.03 FLOOR TILE INSTALLATION

A. All carpet tiles shall be products of one manufacturer, unless specifically indicated otherwise.

B. Shall be pre-approved by owner/owners 10 days prior to bid date

C. Manufacturer shall be currently involved in reuse technology including renewing and repatterning used product to eliminate waste sent to landfills.

D. Carpet shall conform to the CRI Indoor Air Quality Testing Program with specific product certification number. Manufacturer shall have a stated environmental policy and documented waste generation improvements.

PART 3 - EXECUTION

3.01 EXAMINATION

E. Refer to section A part 8.

3.02 PREPARATION

A. Refer to section A part 8.

3.03 INSTALLATION PROCEADURES

A. Install carpet tiles and adhesive in accordance with manufacture’s installation instructions.

B. Carpet to be secured to the floor in compliance with Americans with disabilities Act: (ADA), Section 4.5.3.

C. Proper layout and planning must be completed prior to any application of adhesive or carpet tile.

D. Two working chalk lines must be applied to the floor to insure a straight, square properly aligned installation. These chalklines intersect at the starting point and are exactly 90° to each other.

E. Begin installation using a pyramid technique and aligning the first tile at the intersection of the two chalk lines.

F. Always slide each module into position from the side to prevent trapped yarn. Set each module by firmly rubbing both joints.

G. Modules should be tight but not compressed. Peaking will occur when modules are too tight. Too loose an installation can slip and create obvious gap with use.

H. Arrows are embossed and printed on the back of each module indicating pile direction. All arrows shall run in the same direction.

I. A parallel of "scribe" cutting technique may be used when cutting the modules. Any method leading to a clean, properly sized cut is acceptable.

J. Cuts are most easily and cleanly done through the face of the module.

K. Provide unobstructed spaces for removing and replacing furniture and equipment in the installation area.

L. Concrete slabs must have Relative Humidity (RH) and pH range compliant to manufacturer's QC standards. Refer to Part A section 8.

M. Remove coatings including curing compounds and other substances that are incompatible with adhesives.

N. Install tile carpeting and entry system tile using releasable installation method. Comply with CRI 104, Section 13, Carpet Modules (TileProvide rubber or metal tile carpeting transition divider strip/nosing between carpet tile and walk-off tile when total thickness of each material is not equal. Divider strip nosing and typed selected by Architect.

O. Where tile carpeting does not continue beyond a door to another room, extend carpet tile into door reveals so that carpet tile stops under door when door is in closed position.

P. Remove any adhesives, paint, or other products on the carpet immediately during carpet installation.

3.04 FIELD QUALITY CONTROL

A. Within Arrange for carpet manufacturer to provide field service specialist at commencement of installation to instruct installer in methods and to assure that project conditions are satisfactory.

B. Review CRI 104 for guidelines on temperature, humidity, and ventilation and on "Protecting Indoor Installations".

C. Do not install carpets over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive. Concrete slabs must have Relative Humidity (RH) and pH range compliant to manufacturer's QC standards.he tile carpeting and walk-off tile manufacturer shall provide instructions to designated the proper methods and procedures for cleaning tile carpeting material furnished utilizing the above method.

3.05 CLEANING

D. The tile carpeting and walk-off tile manufacturer shall provide instructions to designated the proper methods and procedures for cleaning tile carpeting material furnished utilizing the above method.

E. Tile carpeting and walk-off manufacturer shall provide a representative to demonstrate cleaning and stain removal processes to maintenance personnel at: (1) 30 days prior to Substantial Completion; (2) at 6 months from date of Substantial Completion and; (3) 11 months from date of Substantial Completion.

F. Remove excess adhesive from floor, base and wall surfaces without damage.

G. Clean floor and base surfaces in accordance with manufacturer's instructions.

H. A commercial upright vacuum with a beater brush approved under the CRI Seal of Approval Green Label program is recommended for vacuuming of all carpet. For a list of approved vacuums visit www.carpet-rug.org

3.06 PROTECTION DURING CONSTRUCTION

A. Protect tile carpeting against damage from construction operations and placement of equipment and fixtures during remainder of construction period as recommended by manufacturer and as required by CRI 104, Section 15, Protection of Indoor Installations. Do not use plastic, adhesive sheet.

END OF SECTION

SECTION 098433 - SOUND ABSORBING PANELS

PART 1 - GENERAL

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

1.01 SUMMARY

A. Section Includes:
   a. Acoustical wall panels.

B. Related Sections include the following:
   a. Division 01 Section “Construction Waste Management”

1.02 REFERENCES

A. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
   b. Performance Requirements:
      1) Surface Burning Characteristics (ASTM E84):
         a) Flame spread: 25 maximum
         b) Smoke Developed: 450 maximum

B. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

1.03 SUBMITTALS

A. Product Data: Submit product data sheet, for specified products.

B. Shop Drawings: Submit shop drawings showing layout, edge profiles and panel components, including anchorage, accessories, finish colors and textures.

C. Samples: Submit selection and verification samples of finishes, colors and textures.

D. Test Reports: Certified test reports showing compliance with specified performance requirements.

1.04 DELIVERY, STORAGE & HANDLING

A. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

C. Handle acoustical wall panels carefully to avoid chipping edges or damaged units in any way

1.05 PROJECT CONDITIONS

A. Temperatures
   1. Maintain substrate surface and ambient temperatures above 55 degrees F, unless required otherwise by manufacturer's instructions.

   2. Do not apply adhesive when substrate surface temperature or ambient temperature is below 55 degrees F.

   3. Maintain these conditions 72 hours before, during, and after installation of vinyl wallcovering.

1.06 WARRANTY

A. Novawall® provides a Limited 2-year Warranty to the Authorized Distributor or Certified Installer for Polyester (PET) Acoustic Panels. This warranty does not cover a significant change to indoor temperature or humidity, damage by others or normal wear and tear. The use of cleaning agents other than by an authorized Novawall distributor or certified installer will void this warranty. Assumes installation is inside an interior installation, with air conditioning with limited exposure to direct or excessive sunlight.

1.07 ENVIRONMENTAL COMMITMENT

A. Novawall Systems, Inc. is committed to our clients' needs and offers a product line that will promote the design and implementation of a healthy sustainable building with minimal impact on the environment while remaining in complete compliance with fire and safety codes as well as maintaining superior product quality"

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Novawall Systems, inc.
   a. 5230 Eisenhower Ave, Alexandria, VA 22304
   b. 1-800-695-6682
   c. Novaform@novawall.com
   d. www.novawall.com

B. Substitution – Approved Equal

2.02 ACOUSTICAL WALL PANELS:

A. Novaform Acoustical Panels:
   e. Composition: Recycled & Virgin PET Recycled content up to 60%
   f. Finish: Smooth face polyester panel. Partly cloudy or combine color selection from the manufacturer color palette.
   g. Thickness: 12mm & 25MM
   h. Standard Panel Size: maximum 48-inch (1219 mm) x 108-inch (2743mm) panel.
   i. Edge Detail: [Square]
   j. Mounting Accessories:
      1) Adhesive/Resin

2) Adhesive/Impaling
3) Magnet
4) Velcro
5) Panel Clip / Z-Clip
6) Aluminum extrusion
7) Aircraft cabling

2.03 FABRICATION

A. General: Utility knife, panel saw or oscillating knife on CNC machine

PART 3 - EXECUTION

3.01 CONSTRUCTION WASTE MANAGEMENT

A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management."

3.02 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.03 EXAMINATION

A. Site Verification of Conditions: Verify that substrate or supporting structure, which has been previously installed under other sections, is acceptable for product installation in accordance with manufacturer's instructions.

B. Do not install panels until unsatisfactory conditions are corrected.

3.04 CLEANING

A. Follow manufacturer's instructions for cleaning panels soiled during installation. Replace panels that cannot be cleaned to as new condition.

B. Keep site free from accumulation of waste and debris.

END OF SECTION 098433

SECTION 099113 – EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of painting work is indicated on drawings and schedules, and as herein specified. See Finish Schedule Legend.

B. Work includes painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated.

C. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.

D. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

E. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Design Team will select these from standard colors or finishes available.

F. Following categories of work are not included as part of field-applied finish work:

G. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, aluminum windows, and finished mechanical and electrical equipment, including light fixtures, switch gear and distribution cabinets.

H. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceiling in concealed areas and generally inaccessible areas.

I. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.

J. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts will not require finishing painting.

K. Following categories of work are included under other sections of these specifications:

L. Shop Priming: Shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.

M.. Do not paint over and code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

1.3 QUALITY ASSURANCE:

A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer and use only within recommended limits.

B. Coordination of Work: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coating system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

C. Standards:

1. All field applied paints finishes shall comply with Green Seal Zero VOC or Low VOC standards. Maximum allowable VOC content for finishes is as follows:

   a. Exterior flat finish: 100 g/l

   b. Exterior non-flat finish: 200 g/l

2. All field applied transparent or semi-transparent wood finishes shall comply with Green Seal Zero VOC or Low VOC standards. Maximum allowable VOC content for finishes is as follows:

   a. Varnish: 350 g/l

   b. Stains: 250 g/l

   c. Sealer: 200 g/l

   d. Waterproof Sealers: 250 g/l

   e. Low Solids Coating 120 g/l

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.

B. FGBC Submittal: Florida Green Building Coalition min. Silver rating

C. Design Team shall submit material selection board with colors for interior and exterior color palate.

D. Samples: Prior to beginning work, Design Team will identify colors for surfaces to be painted. Use representative colors when preparing samples for review. Submit samples for Design Team's review of color and texture only. Provide a listing of material and application for each coat of each finish sample. Provide three (3) samples of each color.

E. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface, as directed, until required sheen, color and texture is obtained; simulate finished lighting conditions for review of in-place work.

F. Final acceptance of colors will be from samples applied on the job.

1.5 DELIVERY AND STORAGE:

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label and following information:

1. Name or title of material.

2. Fed. Spec. number, if applicable.

3. Manufacturer's stock number and date of manufacturer.

4. Manufacturer's name.

5. Contents by volume, for major pigment and vehicle constituents.

6. Thinning instructions.

7. Application instructions.

8. Color name and number.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.

C. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.6 JOB CONDITIONS:

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C), unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C), unless otherwise permitted by paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

1.7 EXTRA MATERIAL:

A. Provide extra stock of each paint color/finish: An amount sufficient to cover 5% of the total surface area for each color, but not less than one gallon.

1.8 WARRANTY

A. Provide a Five (5) year warranty for exterior waterproofing system from Seal Krete.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES:

A. Paint Manufacturer: Subject to compliance with requirements, provide products of one of the following: (or Approved Equal)

1. Exterior - Sherwin Williams 'Superpaint' – Flat, satin, gloss

2. Exterior Primer - Seal Krete heavy duty water proofer

B. Color and finish as per finish schedule and legend.

2.2 PAINT MATERIALS:

A. Material Quality: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade, Low or no VOC product will not be acceptable.

B. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

C. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.

B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

D. Test moisture content of surfaces using an electronic moisture meter. Do not begin application of coatings unless moisture content of exposed surfaces is below the following maximum values:

1. Wood Surfaces: 15 percent.

3.2 SURFACE PREPARATION:

A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

B. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Design Team in writing of any anticipated problems in using the specified coating systems with substrates primed by Contractor Subs.

C. Remove hardware, hardware accessories, machined surfaces, plates, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

D. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

E. Cementitious Materials: Prepare cementitious surfaces of concrete, concrete block, and cement plaster to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.

F. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

G. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

H. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent.

3.3 MATERIALS PREPARATION:

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in a clean condition free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.4 FIELD SAMPLE APPROVAL:

A. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface, as directed, until required sheen, color and texture is obtained; simulate finished lighting conditions for review of in-place work. Shades for each coat shall be distinguishable for each paint sample per section 3.7 E.

B. Final acceptance of colors will be from samples applied on the job.

C. DO NOT proceed with painting throughout the building without in field sample approval.

3.5 PAINT APPLICATION:

A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

B. Paint colors are indicated in "schedules" of the contract documents.

C. Provide finish coats which are compatible with prime paints used. Apply additional coats when undercoats or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

D. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

E. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

F. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.

G. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.

H. Sand lightly between each succeeding enamel coat.

I. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

J. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, pre-treated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

K. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

L. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated as recommended by coating manufacturer.

M. Prime Coats: Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by Contractor to provide.

N. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

O. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth, surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

P. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.6 FIELD QUALITY CONTROL:

A. The right is reserved by City to invoke the following material testing procedure at any time, and any number of times during period of field painting.

B. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.

C. Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectiveness, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, re-coating, skinning, color retention, alkali resistance, and quantitative materials analysis.

D. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

E. Prime coat color shall be (3) shades lower than the final finish color. Mid coat paint color shall be (1) shade lower that the final finish color. Final finish coat shall be the actual color specified in the construction documents. Provide sufficient coverage with each successive coat to fully cover the previous coat until a uniform finish is achieved.

3.7 CLEAN-UP AND PROTECTION:

A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

B. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Design Team.

C. Provide “Wet Paint” signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by Contractor for protection of their work, after completion of painting operations.

D. At completion of work of other trades, touch-up and restore all damaged or defaced surfaces.

3.8 EXTERIOR PAINT SCHEDULE:

A. General: Provide the following paint systems for the various substrates, as indicated (or approved equal).

B. Concrete and Stucco:

1. Satin Finish (10 - 20 Units @ 85°):

a. 1st Coat: SEAL-KRETE Waterproofing Sealer

b. 2nd Coat: SEAL-KRETE Waterproofing Sealer

c. 3rd Coat: ULTRA-CRETE Texture Coating Medium

d. 4th Coat: S-W Super Paint Exterior Latex Satin Extra White A89 - 100

e. 5th Coat: S-W Super Paint Exterior Latex Satin Extra White A89 - 100

C. Ferrous Metal, Primed Metal, Zinc-Coated Metal, and Aluminum (light/medium duty):

1. Gloss Finish (~70 units @ 60°):

a. 1st Coat: S- W Pro-Cryl Universal Metal Primer B66-31 0 Series* 110 g/l VOC

b. 2nd Coat: S- W Water Based Pro Industrial Zero VOC Acrylic Gloss B66 series

c. 3rd Coat: S-W Water Based Pro Industrial Zero VOC Acrylic Gloss B66 series

D. Ferrous Metal, Primed Metal, Zinc-Coated Metal, and Aluminum (heavy duty):

1. Gloss Finish (~70 units @ 60°):

a. 1st Coat: S- W Pro-Cryl Universal Metal Primer B66-31 0 Series* 110 g/l VOC

b. 2nd Coat: S- W Water Based Acrolon 100 Urethane B65 700 Series <100 g/l VOC

c. 3rd Coat: S- W Water Based Acrolon 100 Urethane B65 700 Series <100 g/l VOC

END OF SECTION

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Concrete masonry units (CMU).
3. Steel.
4. Galvanized metal.
5. Aluminum (not anodized or otherwise coated).
6. Wood.
7. Gypsum board.

B. Related Sections include the following:

1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
4. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 SUBMITTALS

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

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches (200 mm) 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.

D. 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.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 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 (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

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 2 percent, but not less than 1 gallon of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.

2. Glidden

3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system 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 coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.

2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.

3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.

4. Floor Coatings: VOC not more than 100 g/L.

5. Flat Topcoat Paints: VOC content of not more than 50 g/L.

6. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.

7. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.

8. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.

9. Dry-Fog Coatings: VOC content of not more than 400 g/L.

10. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.

11. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

2. Restricted Components: Paints and coatings shall not contain any of the following:

a. Acrolein.

b. Acrylonitrile.

c. Antimony.

d. Benzene.

e. Butyl benzyl phthalate.

f. Cadmium.

g. Di (2-ethylhexyl) phthalate.

h. Di-n-butyl phthalate.

i. Di-n-octyl phthalate.

j. 1,2-dichlorobenzene.

k. Diethyl phthalate.

l. Dimethyl phthalate.

m. Ethylbenzene.

n. Formaldehyde.

o. Hexavalent chromium.

p. Isophorone.

q. Lead.

r. Mercury.

s. Methyl ethyl ketone.

t. Methyl isobutyl ketone.

u. Methylene chloride.

v. Naphthalene.

w. Toluene (methylbenzene).

x. 1,1,1-trichloroethane.

y. Vinyl chloride.

D. Colors: As selected by Architect from manufacturer's full range.

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. Wood: 15 percent.

4. Gypsum Board: 12 percent.

5. Plaster: 12 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 in "MPI Architectural Painting Specification Manual" applicable to substrates 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.

D. Concrete 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. Concrete Masonry Substrates: Remove 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.

F. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

G. 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.

H. Aluminum Substrates: Remove surface oxidation.

I. Wood Substrates:

1. Scrape and clean knots and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

J. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

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 equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

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.

E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
1. Mechanical Work:
a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes.
e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or another paintable jacket material.
g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
2. Electrical Work:
a. Switchgear.
b. Panelboards.
c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: City reserves the right to invoke the following procedure at any time and as often as City deems necessary during the period when paints are being applied:

1. City 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 with product requirements.

3. City 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 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System: MPI INT 3.1E.

a. Prime Coat: Interior latex matching topcoat.

b. Intermediate Coat: Interior latex matching topcoat.

c. Topcoat: Interior latex semigloss.

B. Concrete Substrates, Traffic Surfaces:

1. Water-Based Clear Sealer System: MPI INT 3.2G.

a. First Coat: Interior/exterior clear concrete floor sealer (water based).

b. Topcoat: Interior/exterior clear concrete floor sealer (water based).

C. CMU Substrates:

1. Latex System: MPI INT 4.2A.

a. Prime Coat: Interior/exterior latex block filler.

b. Intermediate Coat: Interior latex matching topcoat.

c. Topcoat: Interior acrylic latex semigloss.

D. Steel Substrates:

1. Alkyd Dry-Fall System: MPI INT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.

b. Topcoat: Interior alkyd dry fog/fall.

2. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.

b. Intermediate Coat: Interior latex matching topcoat.

c. Topcoat: Interior latex semigloss.

E. Galvanized-Metal Substrates:

1. Alkyd System: MPI INT 5.3C.

a. Prime Coat: Cementitious galvanized-metal primer.

b. Intermediate Coat: Interior alkyd matching topcoat.

c. Topcoat: Interior alkyd semigloss.

F. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Latex System: MPI INT 5.4H.

a. Prime Coat: Quick-drying primer for aluminum.

b. Intermediate Coat: Interior latex matching topcoat.

c. Topcoat: Interior latex semigloss.

G. Wood Panel Substrates: Including wood veneer, wood trim, plywood.

1. Polyurethane Varnish System: MPI INT 6.4E.

a. Prime Coat: Sanding Sealer.

b. Intermediate Coat: Satin Finish Polyurethane Varnish.

c. Topcoat: Satin Finish Polyurethane Varnish.

H. Gypsum Board Substrates:

1. Latex System: MPI INT 9.2A.

a. Prime Coat: Interior latex primer/sealer.

b. Intermediate Coat: Interior latex matching topcoat.

c. Topcoat: Interior latex flat.

END OF SECTION

SECTION 101400 – SIGNAGE

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior Room Signs

2. Site Wayfinding Signs

B. The City reserves the right to adjust sign quantities prior to issuing a Contract for the Work, and that unit costs for signage shall apply regardless of changes in quantities, and that installation shall be adjusted to reflect changes in sign quantities. Additionally, unit costs for signage shall be guaranteed for not less than 12 months following Award of the Contract.

C. Sign Contractor is responsible for obtaining all applicable sign permits and similar fees.

D. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs. UPDATE

1.2 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.3 PERFORMANCE REQUIREMENTS

A. All signs to comply with current codes for structures, materials, methods of fabrication, and methods of attachment.

1.4 BID SUBMITTALS

A. The following items shall be submitted with the bid.

1. Time requirements for completion of sign products following necessary approvals, including the production of all prototypes for approval, for appropriate partial deliveries and for total completion.

2. Time required following the award of contract for all submittals shall also be indicated.

3. If awarded the contract, the Contractor agrees that time is an essential condition of the contract.

1.5 ACTION SUBMITTALS

A. Product Data: Each type of sign required.

B. Shop Drawings: Show fabrication and installation details for signs.

1. Show sign mounting heights, locations of supplementary supports to be provided by

Contractor or Subs, and accessories. Show anchorage types and locations.

2. Provide message list, typestyles, graphic elements, including tactile characters

and Braille, and scaled layout for each sign.

C. Samples for Verification: Three samples for each of the products used for the project and for the full range of color, texture, and sign material indicated, of sizes indicated.

D. Provide full-size prototype samples of the request sign types for the project delivered per City's instructions. Obtain Architect's approval before fabricating signs for the Work. Approved signs in suitable condition may be incorporated in the Work.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

B. Warranty: Special warranty specified in this Section.

1.8 QUALITY ASSURANCE

A. Single Source: Provide all signs specified in this Section under a single subcontract.

B. Installer Qualifications: An employer of workers trained and approved by manufacturer.

C. Fabricator Qualifications: An employer of workers trained and approved by manufacturer.

D. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

E. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guideline and ICC/ANSI A117.1. Where requirements differ, request clarification from the Architect.

F. Correction of Defective Work: Work determined to be defective by the City or the Inspection Agency or both, regardless of all previous inspection, shall be corrected to the satisfaction of the Architect at no extra cost to the City.

1.9 PROJECT CONDITIONS

A. Field Inspection: Perform an on-site inspection prior to fabrication in order to field verify all existing conditions and notify the City and Architect in advance of any condition affecting the manufacture and/or installation of signs. Verify sign location conditions by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or quality within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metal and polymer finishes beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

B. During the warranty period, the Contractor shall restore defective work to the standards set forth in the Contract Documents without any cost to the City.

C. The joints in acrylic plastic construction shall be warranted for 5 years against failure or

delamination.

D. All interior room signs shall be warranted for 5 years against discoloration and delamination of any portion of the sign.

E. Vinyl die-cut letters shall be warranted for 5 years against delamination from the substrate.

F. Raised letters shall be warranted for 5 years against delamination from the substrate.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

C. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

D. Steel:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial or forming steel.

2. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, Type B, exposed or electrolytic zinc-coated, ASTM A 591/A 591M, with steel sheet substrate complying with ASTM A 1008/A 1008M, commercial steel, exposed.

3. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type [304] [316], stretcher-leveled standard of flatness.

4. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529/A 529M or ASTM A 572/A 572M, 42,000-psi (290-MPa) minimum yield strength.

5. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.

E. Zinc Sheet: Solid, engraver's quality, chemically deep-etched zinc. Magnesium is not an acceptable substitute.

F. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

G. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:

1. Impact Resistance: 16 ft-lbf/in. (854 J/m) per ASTM D 256, Method A.

2. Tensile Strength: 9000 lbf/sq. in. (62 MPa) per ASTM D 638.

3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. (2345 MPa) per ASTM D 790.

4. Heat Deflection: 265 deg F (129 deg C) at 264 lbf/sq. in. (1.82 MPa) per ASTM D 648.

5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044

H. Vinyl Film:

1. Non-reflective vinyl film shall be "Scotchcal" brand as manufactured by the Minnesota Mining and Manufacturing Company (3M), or as approved.

   a. Thickness shall be 0.003 inch minimum and 0.006 inch maximum, or as specified.

   b. The pigmented material shall be sufficiently opaque when applied to completely hide a contrasting black printed legend on a white surface.

   c. Properly processed and applied material shall withstand 5 years vertical, south facing, unprotected, exterior exposure at the work site with no appreciable deterioration such as cracking, checking, blistering, delamination, or loss of adhesion. The material will show no appreciable discoloration after cleaning.

   d. If material will come into contact with gasoline, provide "Scotchcal" brand Gasoline Resistant Clear Coat 3980. Apply to material according to manufacturer's directions to complete installation.

2. Reflective vinyl film shall be "Scotchlite" brand "flat-top" wide angle reflective sheeting No. 3270 silver-sheet, or color specified, engineer grade as manufactured by Minnesota Mining and Manufacturing Company (3M), or as approved.

   a. Thickness shall be 0.0065 inch minimum and 0.0075 inch maximum, or as specified.

   b. The material shall be sufficiently flexible to show no cracking when bent around a 3/4-inch mandrel at 72 degrees Fahrenheit and 50 percent R.H.

   c. Properly processed and applied material shall withstand accelerated weathering for 2 years, south facing, unprotected at 45 degree in South Florida. The material shall remain weather resistant and following cleaning, shall show no appreciable discoloration, cracking, crazing, blistering, or dimensional change and not less than 80 percent of the specified wet and dry minimum brightness values when exposed to above conditions.

   d. If material will come into contact with gasoline, provide "Scotchcal" brand Clear Coat 3920 applied to material according to manufacturer's directions.

3. Shrinkage shall not exceed 1/64 inch (0.4mm) in any direction.

4. Screen inks shall be "Scotchcal" brand opaque screen-printing inks Series 3900, or as approved.

5. Press ink shall be "Scotchcal" brand letterpress inks Series 850, or as approved.

6. For durability of screen and press inks on vinyl film in exterior application a

clear coat shall be added. This clear coat shall be "Scotchcal" brand Clear Coat No. 3920 glass or "Scotchcal" brand gasoline resistant clear coat No. 3980 where emblems or legend are subject to contact with gasoline.

7. Vinyl legends shall be steel rule or die-cut in such a manner that edges, and corners are true, clear and photographically precise. Legends with rounded positive or negative corners, cut or ragged edges or edge build-up will not be accepted.

8. Letterforms supplied that are specified to be installed by the Contractor shall be pre-spaced on a carrier sheet with a cover sheet. The carrier sheet shall be capable of being removed intact by stripping without the use of water or other solvents at the time of use.

9. 3M All Weather Thermoplastic pavement marking shall be by the Minnesota Mining and Manufacturing Company (3M) in colors and applications as shown.

2.2 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.3 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.

2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.

4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

B. All copy must be reproduced accurately and free from distortion. Round positive or negative corners, nicked or ragged edges are not acceptable. Arrows and symbols shall be reproduced exactly by photographic process and be submitted for approval prior to fabrication. The Sign Contractor is responsible for submitting and receiving approvals for any message layouts which must be altered from specifications because of size constraints.

C. Routed Letterforms: All copy that is internally illuminated shall be of the computer-generated type, free of any distortion. Hand cut letterforms are subject to rejection.

D. Support Steel:

1. Fabrication shall comply with requirements of the AISC specifications, unless otherwise specified.

2. Provide all connections necessary for complete erection. Unless otherwise indicated, shop connections shall be welded.

3. Welding shall be in accordance with the approved welding procedures and AWS Structural Welding Code.

4. Furnish loose leveling plates for column erection. Installation of leveling plates is included under this Section.

5. Furnish anchor bolts as indicated to be embedded in concrete, including nuts, lock washers and washers. Detail anchor bolts such that the projection above the nut after column is in place is equal to the diameter of the anchor bolt.

6. Notify Contractors for other trades so that holes in structural steel can be provided for attachment of their work where required. Provide necessary holes if information is received prior to fabrication.

7. Unless otherwise shown, holes for attachment of wood blocking shall be 1/2-inch diameter at 34 inch spacing.

E. Painting:

1. In general, paint application shall be by airless spray. All applications must meet approval of the Design Team and Architect,

2. Apply paint only when the relative humidity is below 85 percent and ambient temperature is above 55 degrees Fahrenheit.

3. Paint shall not be applied until the preceding coat has dried.

4. Clean and prepare surfaces according to the manufacturer's printed instructions.

5. Ferrous Metals:

a. Prepare surface by removing loose mill scale, rust, accessible slag or flux deposit, dirt or any foreign matter by power brushing. Remove oil and grease deposits by solvent.

b. After cleaning, give surface 1 shop coat of prime paint. Apply thoroughly and evenly to a dry surface. Surfaces inaccessible after assembly or erection shall be given an additional shop coat of a different color then the first coat. Each coat shall have a minimum dry film thickness of 2.5 mils.

6. Aluminum shall be pre-treated as recommended by the paint manufacturer, including:

a. Degreasing process and rinse.

b. Chemical etching process and rinse.

c. Deoxidizing process and rinse.

d. Chromate process ASTM B499, rinse and dry.

e. Prime surfaces with manufacturer's recommended primer.

f. Apply paint at the rate of 2.5 mils per coat by air or airless spray, brush or roller. Coating shall be even and free from any marks or streaks.

7. Before application of the finish paint, touch up all chipped or abraded areas within boundaries of graphic painting. Touch up paint shall be of same

formulation and color as original paint.

8. Coatings applied by the approved method shall be thinned only to provide the required workability. Apply coats uniformly, free from runs and brush marks or streaking.

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. 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.

2.5 ALUMINUM FINISHES

A. Urethane Paint (On Aluminum): Paint shall be Matthews acrylic Polyurethane (MAP), an ultraviolet inhibited aliphatic isocyanate/acrylic system. Applied in accordance with manufacturer's recommendations.

2.6 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. Factory Priming for Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.

1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate- free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.7 ZINC FINISHES

A. Interior Signage: Matte sheen.

2.8 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

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 work.

B. Verify that items, including anchor inserts, and electrical power are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 REMOVAL OF EXISTING SIGNS

A. Remove all existing interior directional, identification, and informational signage in areas covered by the new sign package. Confirm list of signs to be removed and coordinate removal schedule with the City.

B. Where signs are removed, patch and repair any wall surfaces that are not otherwise affected by the project.

C. Concession signage is excluded from the removal scope unless otherwise noted by the Contractor. Update as necessary for new facility.

3.3 INSTALLATION

A. Coordinate installation with City to comply with any applicable requirement for work scheduling and procedures.

B. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

1. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door. Comply with guidelines per DOJ 2010 ADA Standards for Accessible Design.

C. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply:

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

2. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.

3. Shim Plate Mounting: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.

4. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

5. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

D. Bracket-Mounted Signs: Provide manufacturer's standard brackets, fittings, and hardware for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.

E. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide

heavy paper template to establish character spacing and to locate holes for fasteners. Characters shall be shaded as a solid for easy legibility of City/Design Team approval prior to installation.

1. Flush Mounting: Mount characters with backs in contact with wall surface.

2. Projected Mounting: Mount characters at projection distance from wall surface indicated.

3.4 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by City.

END OF SECTION

SECTION 102100 – ALUMINUM STATIONARY LOUVERS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Miami-Dade County, Florida approved extruded aluminum stationary louvers.

1.2 RELATED SECTIONS

A. Section 07900 - Joint Sealants.

1.3 REFERENCES:

A. AAMA 605.2 - High Performance Organic Coatings on Construction Documents Architectural Extrusions and Panels.

B. AMCA 500 L- Test Methods for Louvers, Dampers and Shutters.

C. Miami-Dade County, Florida Building Code Compliance Office (BCCO) - Check List for Approval of Wall Louvers.

D. Miami-Dade County, Florida Building Code Test Standard Protocols

E. Electric Service Standards - Requirements for Transformers Situated on Customer Property.

1.4 SUBMITTALS:

A. Comply with requirements of Section 01330 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data including performance data.

C. Sustainability Submittals: Florida Green Building Coalition (FGBC) min. silver rating

D. Shop Drawings: Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.

1.5 QUALITY ASSURANCE:

A. Louvers approved by the Miami-Dade County BCCO for use in open structures that do not have the ability to drain water that may penetrate. Approval based on tests and procedures performed in accordance with BCCO test protocol PA 100(A)-94, PA 201 and PA 203.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Storage: Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

C. Handling: Protect materials and finishes during handling and installation to prevent damage.

1.7 WARRANTY

A. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Failures on finish include, but not limited to, checking, crazing, peeling, chalking, fading and/or loss of adhesion.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

A. Basis-of-Design Product: The basis of design for the fixed glazing system shall be as noted; or comparable product and system by one of the following:

1. United Enertech - (Basis of Design)

   3005 S. Hickory St., Chattanooga, TN 37407

   Phone: (423) 698-7715; Fax: (423) 698-6629

   Email: sales@unitedenertech.com

2. Ruskin Manufacturing

3. Greenheck

4. CS Group

5. Or Approved Equal

2.2 EXTRUDED ALUMINUM STATIONARY LOUVERS:

A. Louver Fabrication:

1. Model: FL – D – 6 – Basis of Design.

2. Frame:

   a. Material: Extruded aluminum, Alloy 6063-T5.

   b. Wall Thickness: 0.081 inch (2.1 mm), nominal.

   c. Depth: 5.1 inches (127 mm).

3. Blades:

   a. Style: Horizontally mounted.

   b. Material: Extruded aluminum, Alloy 6063-T5.

   c. Wall Thickness: 0.081 inch (2.1 mm), nominal.

   d. Centers: 2.13 inches (55 mm), nominal.

4. Bird Screen:

   a. Material: Aluminum, 5/8-inch mesh x 0.040 inch (16 mm mesh x 1 mm), intercrimp.

   b. Frame: Removable, rewireable.

5. Insect Screen: Provide manufacturer's standard.

6. Installation Subframes:

   a. Material: .125" (3.2 mm) thick continuous aluminum channel with .188" (4.7 mm) thick aluminum integral continuous fastening angle to allow installation in any wall system.

7. Assembly: Maximum field assembly size: Unlimited width x 96" high.

B. Louver Performance Data:

1. Based on testing 48-inch x 48-inch (1,219 mm x 1,219 mm) size unit per AMCA 500 L.

2. Free Area: 48 percent, nominal.

3. Free Area Size: 7.84 square feet

4. Maximum Recommended Air Flow Through Free Area: 1,250 feet per minute.

5. Air Flow: 6,366 cubic feet per minute

6. Maximum Pressure Drop: 0.37 inches w.g.

C. Control Damper:

1. Install control dampers as per mechanical drawings. Connect all electrical and mechanical connections.

D. Louver Miami-Dade County Test Performance:

1. PA 201-94 Large Missile Impact Test:

a. Louver must allow no interior penetration after at least six impacts with a 9.0 lb. (4.08 kg) Southern Pine 2" x 4" (51 x 102 mm) board traveling at a minimum of 50 ft/sec (15.24 m/sec).

2. PA 202-94 Uniform Static Air Pressure Test: Louver/damper must withstand pressure tests of each of the following loads:

a. +120 PSF (5.7 kPa) and -120 PSF (5.7 kPa).

b. +160 PSF (7.7 kPa) and -140 PSF (6.7 kPa).

c. +240 PSF (11.5 kPa) and -210 PSF (10.1 kPa).

d. Duration of tests must be at least 30 seconds per load. Louver/damper components shall recover 100% after loading.

3. PA 203-94 Cyclic Wind Pressure Test: Louver/damper must withstand the following pressure cycles:

a. 600 cycles at +80.0 PSF (3.83 kPa) and -70 PSF (3.35 kPa).

b. 70 cycles at +96.0 PSF (4.60 kPa) and -84 PSF (4.02 kPa).

c. 1 cycle at +208.0 PSF (9.96 kPa) and -182 PSF (8.71 kPa).

4. Duration of loads shall be 1 to 3 seconds per cycle. Louver components shall recover 100% after loading.

5. Design Wind Load: Incorporate structural supports and mullions required to withstand design wind load of 138 PSF (6.6 kPa) and maximum test load of 207 PSF (9.90 kPa).

6. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7-10, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

a. Basic Wind Speed: 200 MPH.

b. Exposure Category: C.

c. Building Category: IV (Essential)

d. Enclosed Building

E. Windborne-Debris-Impact-Resistance Performance: Provide aluminum-framed systems that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996.

1. Large-Missile Impact: For louvers located within 60 feet of grade.

2.3 FACTORY FINISH:

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Color and Gloss: Dark Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Inspect areas to receive louvers. Notify the Design Team of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION:

A. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.

B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

C. Install joint sealants as specified in Section 07900.

D. Motorized dampers:

1. Install existing motorized dampers at all louvers, with electric interlock to mechanical equipment. Provide power and control wiring connections to each damper motor.

3.3 CLEANING:

A. Clean louver surfaces in accordance with manufacturer's instructions.

B. Repair minor damaged surfaces as directed by Design Team.

END OF SECTION

SECTION 102113 - TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Compact Laminate (CL Phenolic) Moisture Resistant Substrate: (Bobrick DuraLineSeries).
   1. Toilet partitions.
   2. Urinal privacy screens.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

B. Section 10 28 00 - Toilet Accessories.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. 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.

C. FGBC Submittals:
   1. For Bobrick DuraLineSeries: Materials and Resource Credits - Recycled Content; submit manufacturer's calculation of value of recycled content for specified products, calculated in accordance with FGBC certification requirements.

D. Shop Drawings: Submit manufacturer's shop drawings for each product specified, including the following:
   1. Plans, elevations, details of construction and attachment to adjacent construction.
   2. Show anchorage locations and accessory items.
   3. Verify dimensions with field measurements prior to final production of toilet compartments.

E. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

C. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.

D. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 WARRANTY

A. Manufacturer's standard 25 year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship. Manufacturer's standard 1 year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Bobrick Washroom Equipment, Inc., which is located at: 6901 Tujunga Ave.; North Hollywood, CA 91605-6213; Tel: 818-764-1000; Fax: 818-765-2700; Email:info@bobrick.com; Web:http://www.bobrick.com

B. Basis of Design Products: Based on the quality and performance requirements of the project, specifications are based solely on the products of Bobrick Washroom Equipment, Inc. www.bobrick.com. Location of manufacturing shall be the United States.

C. Substitutions: The Architect will consider products of comparable manufacturers as a substitution, pending the Contractor's submission of adequate documentation of the substitution in accordance with procedures in Division 1 of the Project Manual. Documentation shall include a list of five similar projects of equivalent size where products have been installed for a minimum of two years, and manufacturer's certification that products are fabricated in the United States.

D. Requests for substitutions will be considered in accordance with provisions of

Section 01 60 00 - Product Requirements.

2.2 COMPACT LAMINATE (CL PHENOLIC), MOISTURE RESISTANT SUBSTRATE (Bobrick DuraLineSeries)

A. Compact Laminate (CL Phenolic) Toilet Partitions: Bobrick DuraLineSeries 2182G.
   1. Design Type:
      a. Maximum Height.
         1) Door/Panel Height: 71 ½ inches
            Floor Clearance: 9”

   2. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.300 inches from the edge to allow for 0.175 inch (4.4 mm) overlap to prevent line-of-sight into the toilet compartment. Privacy strips fastened or adhered onto the partition material are not acceptable.
   3. Mounting Configuration:
      a. Floor-Mounted, overhead-braced with satin finish, extruded anodized aluminum headrails, 0.065 inch thick with anti-grip profile.
         1) Stile Maximum Height: 83 inches

B. Materials: Solidly fused plastic laminate with matte-finish melamine surfaces; integrally bonded colored face sheets and black phenolic-resin core.

C. Edges: Black; brown edges not acceptable.

D. Color:
   1. Color: Other color as selected by architect based on Manufacturer's range and confirmed by local Manufacturer Representative.

E. Fire Resistance:
   1. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class A

F. Finished Thickness:
   1. Stiles and Doors: 3/4 inch
   2. Panels and Screens: 1/2 inch

G. Stiles: Floor-Anchored stiles furnished with expansion shields and threaded rods.
   1. Leveling Devices: 7 gauge, 3/16 inches thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8 inch (10 mm) diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
   2. Stile Shoes: One-piece, 22 gauge 18-8, Type 304 stainless steel, 4 inch (102 mm) height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch or 1 inch stile thickness and capable of being fastened (by clip) to stiles starting at wall line.

H. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable.

I. Hardware:

1. Compliance: Operating force of less than 5 lb (2.25 kg).
2. Emergency Access: Hinges, latch allow door to be lifted over keeper from outside compartment on inswing doors.
   Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
3. Fastening: Hardware is secured to door and stile with pin-in-head Torx stainless steel machine screws. Hinges, latch and optional door stops secured to door with pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners for hinges, latch and optional door stops secured directly into core not acceptable.
   a. Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb (680 kg) per insert.
4. Clothes Hooks: Projecting no more than 1-1/8 inch (29 mm) from face of door.
5. Door Latch: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16-gauge sliding door latch, 14-gauge keeper. Occupancy indicators to be included.
6. Locking: Door locked from inside by sliding door latch into keeper.
7. Hinge Type:
   a. Standard.
      1) Balanced, with field-adjustable cam to permit door to be fully closed or partially open when compartment is unoccupied.
8. Mounting Brackets:
      1) Concealed stainless steel mounting brackets.

PART 3 EXECUTION

3.1 PREPARATION

A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions.
   1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
   2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.

B. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.2 INSTALLATION

A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
   1. Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.
   2. Verify location does not interfere with door swings or use of fixtures.
   3. Use fasteners and anchors suitable for substrate and project conditions.

4. Install units rigid, straight, plumb, and level.
5. Conceal evidence of drilling, cutting, and fitting to room finish.
6. Test for proper operation.

3.3 ADJUSTING, CLEANING AND PROTECTION

A. Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.

B. Touch-up, repair or replace damaged products.

C. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION

SECTION 102226 - OPERABLE PARTITIONS ACOUSTI-SEAL®

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. Manually operated, paired panel operable partitions.
B. Related Sections include the following:
   1. Division 03 Sections for concrete tolerances required.
   2. Division 05 Sections for primary structural support, including pre-punching of support members by structural steel supplier per operable partition supplier's template.
   3. Division 06 Sections for wood framing & supports, and all blocking at head and jambs as required.
   4. Division 09 Sections for wall and ceiling framing at head and jambs.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.
B. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.
C. Preparation of the opening shall conform to the criteria set forth per ASTM E557 *Standard Practice for Architectural Application and Installation of Operable Partitions.*
D. The operable wall must be manufactured by a certified ISO-9001-2015 company or an equivalent quality control system.

1.4 REFERENCE STANDARDS

A. ASTM International
   1. ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.
   2. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
   3. ASTM C1036 - Standard Specification for Flat Glass.
   4. ASTM C1048 - Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
   5. ASTM E84 - Surface Burning Characteristics of Building Materials.
   6. ASTM E413 - Classification for Rating Sound Insulation
B. Health Product Declaration Collaborative
   1. Health Product Declaration Open Standard v2.1
C. International Standards Organization
   1. ISO 14021 - Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labeling).

2. ISO 14025:2011-10, Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures.
3. ISO 14040:2009-11, Environmental Management - Life Cycle Assessment - Principles and Framework.
4. ISO 14044:2006-10, Environmental Management - Life Cycle Assessment - Requirements and Guidelines.
5. ISO 21930 – Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services.

D. Other Standards
1. ADA – Americans with Disabilities Act.
2. ANSI Z97.1 - Safety Glazing Materials Used in Buildings.
3. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
4. NEMA LD3 - High Pressure Decorative Laminates.

1.5 SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.
B. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.
C. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.
D. Samples: Color samples demonstrating full range of finishes available by architect. Verification samples will be available in same thickness and material indicated for the work.
E. Reports: Provide a complete and unedited written sound test report indicating test specimen matches product as submitted.
F. Create spaces that are healthy for occupants.
1. Furnish products and materials with Health Product Declaration (HPD), Manufacturer Inventory, or other material health disclosure documentation. Products without an HPD or other disclosure documentation are not acceptable.

G. Furnish materials that generate the least amount of pollution.
1. Furnish products and materials that have third party verified environmental product declarations (EPD's). Consider products and materials that have optimized environmental performance (reduced life cycle impacts). Products without an EPD or other disclosure documentation are not acceptable.

H. Buy American: Folding door to be manufactured in the United States in compliance with applicable U.S. Federal Trade Commission (FTC) and U.S. Customs Service and Border Protections regulations and be labeled "Made in America".

1.6 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.
B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.7 WARRANTY

A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.
B. Warranty period: Two (2) years.
C. Suspension System Warranty:
    1. OP-01: Five (5) years.
    2. OP-02: Five (5) years.

PART 2 – PRODUCTS

2.1 MANUFACTURERS, PRODUCTS, AND OPERATION

A. Manufacturers: Subject to compliance with requirements, provide product by the following:
    1. Modernfold, Inc.
B. Doors to be manufactured in the U.S.A.
C. Products: Subject to compliance with the requirements, provide the following product:
    1. OP-01: Acousti-Seal Legacy - Paired Panel: Manually operated paired panel operable partition.
    2. OP-02: Acousti-Seal Legacy - Paired Panel: Manually operated paired panel operable partition.

2.2 OPERATION

A. OP-01: Acousti-Seal Legacy - Paired Panel: Series of paired flat panels hinged together in pairs, manually operated, top supported with operable floor seals.
B. OP-02: Acousti-Seal Legacy - Paired Panel: Series of paired flat panels hinged together in pairs, manually operated, top supported with operable floor seals.
C. Final Closure:
    1. OP-01: Horizontally expanding panel edge with removable crank
    2. OP-02: Horizontally expanding panel edge with removable crank

2.3 PANEL CONSTRUCTION

A. OP-01: Nominal 3-inch (76mm) thick panels in manufacturer's standard 48-inch (1220mm) widths. All panel horizontal and vertical framing members fabricated from minimum 16-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
B. Panel skin shall be:
C. OP-02: Nominal 3-inch (76mm) thick panels in manufacturer's standard 48-inch (1220mm) widths. All panel horizontal and vertical framing members fabricated from minimum 16-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
D. Panel skin shall be:
    1. OP-01: Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction minimum:
        a. 50 STC
    2. OP-02: Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction minimum:

a. 50 STC

E. Hinges for Panels, Closure Panels, Pass Doors, and Pocket Doors shall be:
   1. OP-01: Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.
   2. OP-02: Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.

F. Panel Trim: No vertical trim required or allowed on edges of panels; minimal groove appearance at panel joints.

G. Panel Weights:
   1. OP-01: 50 STC - 8 lbs./square foot
   2. OP-02: 50 STC - 8 lbs./square foot

2.4 PANEL FINISH

A. Panel finish shall be:
   1. OP-01: Reinforced vinyl with woven backing weighing not less than 20 ounces (567 grams) per lineal yard.
   2. OP-02: Reinforced vinyl with woven backing weighing not less than 20 ounces (567 grams) per lineal yard.

B. Panel Trim: Exposed panel trim of one consistent color:
   1. OP-01: To Be Advised
   2. OP-02: To Be Advised

2.5 SOUND SEALS

A. Vertical Interlocking Sound Seals between panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals or astragals in only one panel edge are not acceptable.

B. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.

C. Horizontal bottom floor seals shall be:
   1. OP-01: Modernfold SM2 Bottom Seal. Manually activated seals providing nominal 2" (51mm) operating clearance with an operating range of + 0.50" (13mm) to -1.50" (38mm). Seal shall be operable from panel edge or face. Extended seal shall exert nominal 120 pounds (54 kg) downward force to the floor throughout operating range.
   2. OP-02: Modernfold SM2 Bottom Seal. Manually activated seals providing nominal 2" (51mm) operating clearance with an operating range of + 0.50" (13mm) to -1.50" (38mm). Seal shall be operable from panel edge or face. Extended seal shall exert nominal 120 pounds (54 kg) downward force to the floor throughout operating range.

2.6 SUSPENSION SYSTEM

A. OP-01: #17 Suspension System
   1. Suspension Tracks: Minimum 11-gauge, 0.12-inch (3.04mm) roll-formed steel track, suitable for either direct mounting to a wood header or supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 0.38-inch (10mm) diameter threaded rods. Aluminum track is not acceptable.
      a. Exposed track soffit: Steel, integral to track, and pre-painted off-white.

2. Carriers: One all-steel trolley with steel tired ball bearing wheels per panel (except hinged panels). Non-steel tires are not acceptable.

B. OP-02: #17 Suspension System
1. Suspension Tracks: Minimum 11-gauge, 0.12-inch (3.04mm) roll-formed steel track, suitable for either direct mounting to a wood header or supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 0.38-inch (10mm) diameter threaded rods. Aluminum track is not acceptable.
a. Exposed track soffit: Steel, integral to track, and pre-painted off-white.
2. Carriers: One all-steel trolley with steel tired ball bearing wheels per panel (except hinged panels). Non-steel tires are not acceptable.

2.7 OPTIONS

A. Available accessories/options:
1. OP-01: Pocket Doors: Acousti-Seal Pocket Doors by Modernfold, Inc., with same construction, finish, and appearance as the adjacent panels.
a. Pocket Door configuration shall be manually operated: Type II double door hinged to a jamb on each side and closing in the center.
2. OP-02: Pocket Doors: Acousti-Seal Pocket Doors by Modernfold, Inc., with same construction, finish, and appearance as the adjacent panels.
a. Pocket Door configuration shall be manually operated: Type II double door hinged to a jamb on each side and closing in the center.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.
B. Install operable partitions and accessories after other finishing operations, including painting have been completed.
C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.
D. Broken, cracked, chipped, deformed or unmatched panels are not acceptable.

3.2 CLEANING AND PROTECTION

A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer’s written instructions.
B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and Installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.3 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.4 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of

operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 DEMONSTRATION

A. Demonstrate proper operation and maintenance procedures to City.
B. Provide Operation and Maintenance Manual to City.

A. MANUFACTURES:
Modernfold, Inc.
215 West New Road
Greenfield, IN 46140
Toll Free: 800.869.9685
email: info@modernfold.com
www.modernfold.com

B. SUBSTITUTIONS:
Or approved equal with matching quantities, finishes, accessories & warranties.

END OF SECTION

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Crash rails.

2. Corner guards.

B. Related Sections:

1. Division 08 Section "Door Hardware" for metal armor, kick, mop, and push plates.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

1. 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.

C. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.

1. Include similar Samples of accent strips and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Wall and Corner Guards: 12 inches (300 mm) long. Include examples of joinery, corners, end caps, top caps, and field splices.

E. Qualification Data: For qualified Installer.

F. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.

G. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Division 01 Section "Quality Requirements."

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 the Architect for review.

D. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, The Florida Accessibility Code and ICC/ANSI A117.1.

E. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

a. Store corner-guard covers in a vertical position.

b. Store crash rails covers in a horizontal position.

1.6 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 (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant 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.

2. Warranty Period: Five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Guard Covers: Full-size stainless-steel covers of maximum length equal to 1 percent of each type, color, and texture of units installed, but no fewer than two, 8-foot-

(2.4-m) long units.

2. Corner-Guard Covers: Full-size stainless-steel covers of maximum length equal to 1 percent of each type, color, and texture of units installed, but no fewer than two, 4-foot-(1.2-m-) long units.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M.

B. 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.

C. Adhesive: As recommended by impact-resistant stainless-steel wall protection manufacturer

2.2 WALL GUARDS

A. Crash Rail: Heavy-duty assembly consisting of continuous stainless-steel cover installed over concealed retainer system; designed to withstand impacts.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated below or an approved equal:

a. Korogard Wall Protection Systems #CS55.

b. Or approved equal.

2. Cover: Stainless steel, minimum 16 ga wall thickness, as follows:

a. Profile: Flat with groove, 5-1/2" face dimension.

1) Dimensions: Nominal 5-1/2 inches high by 1-1/2" inch deep.

2) Surface: Grooved.

b. Color and Texture: Satin stainless steel.

3. End Caps and Corners: Prefabricated, stainless steel matching cover; field adjustable for close alignment with riveted cover.

4. Accessories: Concealed splices and mounting hardware.

5. Mounting: Surface mounted directly to wall.

2.3 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards Fabricated from one-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable approved equal product:

a. Korogard Wall Protection Systems #GS30.

b. Or approved equal

2. Material: Stainless steel, Type 304.

a. Thickness: Minimum 16 ga.

b. Finish: Directional satin, No. 4.

3. Wing Size: Nominal 3 by 3 inches.

4. Corner Radius: 1/8 inch (3 mm).

5. Mounting: Adhesive.

2.4 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. 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.

2.5 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.

4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant 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.

1. For impact-resistant wall protection units attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. 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 crash rails and corner guards at all common areas and main corridors. Install impact-resistant 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 impact-resistant wall protection units in locations and at mounting heights indicated below:

a. Crash Rails: Top of rail at 36" above finished floor.

2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.

b. Adjust end caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

SECTION 102800 - TOILET AND BATH ACCESSORIES

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 work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of each type of toilet accessory is indicated on drawings and schedules. See restroom elevation sheets.

B. Products furnished and installed by General Contractor under this section include the following:

1. Paper towel dispenser with waste basket combination
2. Grab bar.
3. Surface mounted sanitary napkin disposal unit.
4. Robe hook.
5. Adjustable motor sensored Hand Dryer
6. Mirror
7. Surface mounted soap dispenser
8. Plumbing protection
9. Toilet tissue dispenser, surface mounted
10. Partition mounted sanitary napkin disposal
11. Baby changing station
12. Utility shelf
13. Lavatory System

1.3 QUALITY ASSURANCE:

A. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

B. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

C. Products: Provide products of same manufacturer for each type of accessory unit and for units exposed in same areas, unless otherwise acceptable to the City.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical data and installation instructions for each toilet accessory.

1.5 WARRANTY:

A. Manufacturer’s standard warranty shall be submitted for all toilet and bath accessories.

PART 2 - PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide toilet accessories by one of the following:

A. Basis of Design: As indicated on drawings.

B. Or Architect approved equal

2.2 MISCELLANEOUS ACCESSORIES:

A. General: No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item by either a printed, waterproof label or a stamped name plate indicating manufacturer's name and product model number.

B. Double Robe Hook: Heavy-duty satin finished stainless steel double prong robe hook; rectangular wall bracket with backing plate for concealed mounting.

C. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

D. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all welded construction, without mitered corners. Hang doors or access panels with full-length stainless steel piano hinge. Provide anchorage which is fully concealed when unit is closed.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install toilet accessory units in accordance with manufacturers' instructions, using fasteners which are appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level, firmly anchored in locations and at heights indicated.

B. No accessory shall project more than 4” from the finished wall surface.

3.2 ADJUSTING AND CLEANING:

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish all exposed surfaces after removing temporary labels and protective coatings.

END OF SECTION

SECTION 104413 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.2 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide.

B. NFPA 10 - Standard for Portable Fire Extinguishers.

C. UL (DIR) - Online Certifications Directory.

1.3 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.4 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguishers:

1. Ansul, a Tyco Business: www.ansul.com/#sle.

2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.

3. Nystrom, Inc: www.nystrom.com/#sle.

4. Oval Brand Fire Products: www.ovalfireproducts.com/#sle.

5. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. FE-36 Clean Agent Type Fire Extinguishers: Stainless steel tank, with pressure gauge.

1. Class: A:B:C type.
2. Size: 10 pound.
3. Finish: Baked polyester powder coat, color as selected.
4. Temperature Range: Minus 40 degrees F to 120 degrees F.

2.3 FIRE EXTINGUISHER CABINETS

A. Cabinet Configuration: Recessed type.
1. Size to accommodate accessories.
2. Trimless type.
3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

B. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

C. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

E. Weld, fill, and grind components smooth.

F. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.

G. Finish of Cabinet Interior: White colored enamel.

2.4 ACCESSORIES

A. Extinguisher Theft Alarm: Battery operated alarm, 10 second delay for disarming, activated by opening cabinet door.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place extinguishers in cabinets.

END OF SECTION

SECTION 105113 –METAL LOCKERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Heavy Duty Knocked Down Lockers.

B. Locker benches.

1.02 REFERENCES

A. ADAAG - Americans with Disabilities Act, Accessibility Guidelines.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. 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.

C. Shop Drawings: Show the following:
   1. Dimensioned drawings including plans, elevations, and sections to show locker locations and interfaces with adjacent substrates.
   2. Details of assembly, erection, anchorage and clearance requirements.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect locker finish and adjacent surfaces from damage.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Penco Products, Inc., located at: 1820 Stonehenge Drive, Greenville, NC 27858; Tel: 800-562-1000; Fax: 800-248-1555; Email: general@pencoproducts.com; Web: www.pencoproducts.com or approved equal.

B. Lockers shall be GREENGUARD Gold Certified by UL Environment through the GREENGUARD Certification Program.

2.02 MATERIALS

A. Steel: Prime grade mild cold-rolled sheet steel free from surface imperfection, capable of taking a high-grade enamel finish and in compliance with ASTM A1008.

B. Steel: Sheet steel components shall be fabricated using zinc-coated steel free from surface imperfection, capable of taking a high-grade enamel finish and in compliance with ASTM A879.

C. Bolts and Nuts: Zinc plated truss fin head bolts and hex nuts.

D. Provide only metal lockers fabricated in the United States by a single domestic manufacturer.

2.03 HEAVY DUTY LOCKERS

A. Heavy Duty Lockers: All locker body components made of cold rolled steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.
   1. Lockers with Doors: Penco Invincible II, knock-down lockers, with 6 inch legs (legs are standard).
   2. Lockers with Doors: Penco Invincible II, knock-down lockers, with no legs (no legs are optional).

B. Locker Body Construction: Steel specially formed for added strength and rigidity and to e ensure tight joints at fastening points.
   1. Sides, Bottoms, Tops, and Shelves:
      a. 16 gauge steel.
      b. Ventilation: 3/4 inch (19 mm) wide by 1-1/2 inch (38 mm) high diamond-shaped perforations.
      c. Solid sides.
   2. Backs: Solid 18 gauge steel.
   3. Doors:
      a. 14 gauge steel.
      b. Ventilation: 3/4 inch (19 mm) wide by 1-1/2 inch (38 mm) high diamond-shaped perforations.
      c. Solid doors.
   4. Tops and bottoms with three sides formed 90 degrees, the front offset formed to be flush with horizontal frame member.
   5. Shelves with four sides formed to 90 degrees, front edge having a second bend.
   6. Hole spacing in locker body construction: Not exceeding 9 inches (225 mm).
   7. Two- and three-tier lockers: Intermediate channel-shaped horizontal frame members attached to side frames with mortise and tenon construction, securely welded.
   8. Optional factory assembly of locker bodies using rivets.

C. Locker Doors: One piece sheet steel.
   1. Multi-Point Latch Doors: Full channel formation of adequate depth to fully conceal lock bar on lock side, channel formation on hinge side, right angle formations across top and bottom, with holes for attaching number plates.
   2. Single Point Latch Doors: 14 gauge door reinforced by a full height 3-1/2 inch (89 mm) wide, 18 gauge vertical pan welded to the top, bottom and hinge side flanges and rear of door skin on 12 inch (305 mm), 15 inch (381 mm) and 18 inch (457 mm) wide doors. Provide a horizontal pan for doors wider than 18 inches (457mm).
   3. Single Point Latch Doors: 14 gauge door reinforced by a full 18 gauge inner pan welded to outer door skin on all four sides.
      a. Solid outer door, solid inner pan
      b. Diamond perforated outer, offset diamond perforated inner pan.
      c. 3 inch or 6 inch louvered outer door, mini louvered inner pan.
      d. Mini louvered outer, mini louvered inner pan.

4. Doors over 15 inches (380 mm) Wide and 30 inches (0.762 m) high: Provided with 3 inch (75 mm) wide 20 gauge full height reinforcing pan welded to inside face of door at 6 inch (150 mm) centers.
5. Box Lockers (4 to 9 Tiers): Channel formations on lock and hinge sides; right angle flanges on top and bottom with friction catch door pull.
6. Provide holes for attaching number plates.
7. Ventilation:
   a. Doors 20 inches (508 mm) or higher: 3/4 inch (19 mm) wide by 1-1/2 inch (38 mm) high diamond-shaped perforations.
   b. All other doors: 7/16 inch (11 mm) wide by 15/16 inch (24 mm) high diamond-shaped perforations.
8. Ventilation: Provide louvered doors in manufacturer's standard louver pattern.
9. Ventilation: Provide louvered doors in manufacturer's standard mini-louver pattern, louvers 5/8 inch (15.8 mm) wide and 1/4 inch (6.3 mm) high.
10. Ventilation: Provide fully louvered doors in manufacturer's standard full louver pattern.
11. No Ventilation: Provide with solid doors.

D. Hinges:
1. Hinge: 0.074 inch (1.88 mm) thick sheet steel, double spun, full loop, tight pin, projection welded to door frame and securely fastened to the door.
   a. Doors over 48 inches (1.066 m) high: Three 2 inch (51 mm) high five-knuckle hinges.
   b. Doors 24 inches (609 mm) wide by 60 inches (1.524 m) or 72 inches (1.828 m) High: Four 2 inch (51 mm) high five-knuckle hinges.
   c. All other doors: Two 2 inch (51 mm) high five-knuckle hinges.
2. Continuous Hinges: Continuous piano hinge for the full height of the door.

2.04 DOOR HANDLES AND LATCHING

A. 1, 2 and 3 Tier Lockers:
1. Single-point latching:
   a. Recess handle in door.
   b. Integral Pocket and Pull: 22 gauge brushed stainless steel securely fastened to door with two lugs and a positive tamper-resistant decorative fastener.
      1) Pocket Depth: Sufficient to prevent a combination padlock, built-in combination lock, or key lock from protruding beyond door face.
      2) Pull: Formed in pocket.
      3) Padlock Staple: Protruding through pocket.
   c. Provide lock hole cover plate for use with padlocks.
   d. Locking Device: 11 gauge steel hasp welded to locker frame; include surface for engaging the bolt of a built-in combination or key lock and anti-pry lug and slot to deter prying open when locked.
   e. Firmly secure rubber silencers to locker frame.
2. Multi-point latching with recessed handles:
   a. Recess finger-lift control handle in door.
   b. Pocket: 22 gauge brushed stainless steel securely fastened to door with two tabs and a positive tamper-resistant decorative fastener; of depth sufficient to prevent a combination padlock, built-in combination lock, or key lock from protruding beyond door face.
   c. Provide lock hole cover plate for use with padlocks.

d. Attach 14 gauge formed steel lifting piece to latching channel with one concealed retaining lug and one rivet, assuring a positive two-point connection.
e. Handle Finger Lift: Molded, sound-deadening, attached with rivet; padlock eye for use with 9/32 inch (7.1 mm) diameter padlock shackle.
f. Latch Clip: Glass-filled nylon engaging the door frame and holding the door shut.
   1) Doors 60 inches (1.524 m) and 72 inches (1.828 m) high: Three points.
   2) Doors 20 inches (0.508 m) to 48 inches (1.22 m) high: Two points.
g. Locking Device: Positive, automatic type, whereby locker may be locked when open, then closed without unlocking.
h. Firmly secure one rubber silencer in frame at each latch hook.

2.05 INTERIOR EQUIPMENT

A. ADA-Compliant Lockers (Recessed Handles with Multi-Point Latch):
   1. Single Tier Lockers: Hat shelf at maximum 48 inches (1.219 m) off the floor for unobstructed forward and side reach.
   2. Locker Compartment Bottom: Minimum of 15 inches (230 mm) off the floor, or an extra shelf placed 15 inches (381 mm) off the floor for unobstructed forward and side reach.
   3. Handicapped symbol attached to door.
   4. Hooks and rods as specified for other lockers.

2.06 ACCESSORIES

A. Number Plates: Provide each locker with a polished aluminum number plate, 2-1/4 inches (57 mm) wide by 1 inch (25 mm) high, with black numerals not less than 3/8 inch (9.5 mm) high; attach to face of door with two aluminum rivets.

B. Closed Bases: 18 gauge closed metal front and end bases, finished to match lockers.

C. Locks: Built-in grooved key locks (pin tumbler); control-key to same series.

D. Locks: Built-in three-number dialing combination locks capable of at least five different combinations changes; provide control key, combination change key, and combination control charts.
   1. Horizontal bolt
   2. Wrap around/rotary bolt

2.07 FABRICATION

A. Fabricate lockers square, rigid, without warp, with metal faces flat and free of distortion.

B. Knock-Down Lockers: Fabricate lockers on the unit principle, each locker with individual door and frame, individual top, bottom, back, and shelves, with common intermediate divisions separating compartments. Verify dimensions and arrangement before fabrication.

C. Finish: Enamel powder coat paint finish electrostatically applied and properly cured to manufacturer's specifications for optimum performance. Finishes containing volatile organic

compounds and subject to out-gassing are not acceptable. Locker exterior and interior shall be painted the same color.

1. Powder Coat - Dry Thickness: 1 to 1.2 mils (0.025 to 0.03 mm).
2. Powder Coat Plus - Dry Thickness: 2 to 2.2 mils (0.05 to 0.055 mm).
3. Color: As selected from manufacturer's standard colors.
4. Special Finish
   a. Custom color
   b. Anti-Graffiti
   c. Anti-Microbial
   d. TGIC
   e. Ultra-Weatherable.

PART 3 – EXECUTION

3.01 EXAMINATION

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

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

3.02 INSTALLATION

A. Install metal lockers and accessories at locations shown in accordance with manufacturer's instructions.

B. Install lockers plumb, level, and square.

C. Anchor lockers to floor and wall at 48 inches (1.219 m) or less, as recommended by the manufacturer.

D. Bolt adjoining locker units together to provide rigid installation.

E. Install sloping tops and metal fillers using concealed fasteners. Provide flush hairline joints against adjacent surfaces.

F. Install front bases between legs without overlap or exposed fasteners. Provide end bases on exposed ends.

G. Install benches by fastening bench tops to pedestals and securely anchoring to the floor using appropriate anchors for the floor material.

3.03 ADJUSTING AND CLEANING

A. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.

B. Adjust built-in locks to prevent binding of dial or key and ensure smooth operation prior to substantial completion.

C. Touch-up with factory-supplied paint and repair or replace damaged products before substantial completion.

3.04 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 107300 - OVERHEAD SUPPORTED ALUMINUM CANOPY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pre-engineered, pre-finished Suspended extruded aluminum canopies.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA):

1. AAMA 603 - Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.

2. AAMA 605 - Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

3. AAMA 607.1 - Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

4. AAMA 608.1 - Voluntary Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

1.3 DESIGN REQUIREMENTS

A. Struts, Gutter Beams, Deck, and Trim: Aluminum extrusions.

B. Structural Framing: Interlocking deck sections secured by screws.

C. Canopy: Self-draining from deck into perimeter gutter frame through scuppers to discharge point at ground level or as otherwise shown.

D. Building Code: latest Florida Building Code (2020)

E. Design Loads:

1. Comply with Building Code and Structural Drawings for site location.

F. Structural Design: Prepare complete structural design calculations signed and sealed by a professional engineer licensed in the State of Florida for canopy members.

1.4 SUBMITTALS

A. Submit under provisions of Section 013000.

B. Product Data: Manufacturer's catalog data, detail sheets, and specifications.

C. Shop Drawings: Layout and erection drawings showing roof framing, deck panels, cross sections, and trim details, clearly indicating proper assembly.

D. Samples: Color selection samples consisting of actual coating material or anodizing process on aluminum extrusions.

E. Quality Assurance/Control Submittals:

1. Qualifications: Letter certifying manufacturer's required qualifications.

2. Structural Design Calculations.

3. Manufacturer's Installation Instructions.

1.5 QUALITY ASSURANCE

A. Overall Standard: Structural engineering design documents stamped by a structural engineer registered to practice in the State of Florida.

B. Manufacturer Qualifications: Minimum five years' experience in producing covers/canopies of the type specified.

C. Installer Qualifications: Minimum two years' experience in erecting covers/canopies of the type specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Follow manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

Perfection Architectural Systems, Inc., or EQUAL.

2310 Mercator Drive Orlando, FL 32807; ASD.

Tel: (800) 238-7207, Fax: (407) 671-8252.

1. Request for substitutions will be considered in accordance with provisions of Section 016000

B. Provide all overhead supported canopy components from a single manufacturer.

2.2 MATERIALS

A. Aluminum Extrusions: 6063 alloy, T-6 temper.

2.3 COMPONENTS

A. Struts:

1. Aluminum tubular extrusion of size shown on shop drawings.

B. Gutter Beam:

1. Size: As shown on shop drawings.

C. Deck: Rigid-Roll-Lock extruded aluminum, self-flashing, interlocking sections.

1. Size and Profile: As shown on shop drawings.

2. Size and Profile: As required by structural engineering design.

D. Flashing: Aluminum sheet, thickness as recommended by manufacturer for specific condition.

2.4 ACCESSORIES

A. Fasteners:

1. Deck Screws: No. 14 by 1 inch (25 mm), self-tapping, Type 18-8 stainless steel with neoprene washers.

2. Trim Screws: No. 10 by 1/2 inch (13 mm), self-tapping, Type 18-8 stainless steel.

3. 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. Struts:

1. Fluoropolymer Coating: 70 percent PVDF resin-based fluoropolymer, AA-C-12C-42R-1, custom color as selected by architect, comply with AAMA 605.

a. Three coat application.

B. Deck:

1. Fluoropolymer Coating: 70 percent PVDF resin-based fluoropolymer, AA-C-12C-42R-1, custom color as selected by architect, comply with AAMA 605.

a. Three coat application.

C. Fascia/Gutter:

1. Fluoropolymer Coating: 70 percent PVDF resin-based fluoropolymer, AA-C-12C-42R-1, custom color as selected by architect, comply with AAMA 605.

a. Three coat application.

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 surfaces.

D. Commencement of work by installer is acceptance of existing conditions.

3.2 ERECTION

A. Erect protective covers in accordance with manufacturer's installation instructions.

B. Set plumb, straight, and true to line, adequately braced to maintain position.

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. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from the site.

3.4 PROTECTION

A. Protect finished aluminum surfaces from damage due to subsequent construction operations.

END OF SECTION

107310 SECTION - PROTECTIVE COVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pre-engineered, pre-finished extruded aluminum walkway covers.

B. Pre-engineered, pre-finished extruded aluminum canopies.

1.2 RELATED SECTIONS

A. Section 031000- Concrete Forms and Accessories.

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 603 - Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
   2. AAMA 605 - Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
   3. AAMA 607.1 - Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
   4. AAMA 608.1 - Voluntary Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

1.4 DESIGN REQUIREMENTS

A. Columns, Beams, Deck, and Trim: Aluminum extrusions.

B. Structural Framing: Interlocking deck sections secured by screws.
   1. Heli-arc welded, one-piece rigid bents.
   2. Mechanically fastened bents using internally concealed bolted connections.

C. Canopy: Self-draining from deck through bents to discharge point at ground level or as otherwise shown.

D. Building Code: Florida Building (2020) Latest Version.

E. Design Loads:
   1. Comply with Building Code and Structural Drawings for site location.
   2. Collateral Loads: Additional loads imposed by other materials or systems identified in contract documents.

F. Structural Design: Prepare complete structural design calculations signed and sealed by a professional engineer licensed in the State of Florida for canopy members except footings. Provide reactions as required for footing design by a registered professional engineer.

1.5 SUBMITTALS

A. Submit under provisions of Section 013000.

B. Product Data: Manufacturer's catalog data, detail sheets, and specifications.

C. Shop Drawings: Layout and erection drawings showing roof framing, deck panels, cross sections, and trim details, clearly indicating proper assembly.

D. Samples: Color selection samples consisting of actual coating material or anodizing process on aluminum extrusions.

E. Quality Assurance/Control Submittals:
1. Qualifications: Letter certifying manufacturer's required qualifications.
2. Structural Design Calculations.
3. Manufacturer's Installation Instructions.

1.6 QUALITY ASSURANCE

A. Overall Standard: Structural engineering design documents stamped by a structural engineer registered to practice in the State of Florida.

B. Manufacturer Qualifications: Minimum five years experience in producing covers/canopies with welded bents and of the type specified.

C. Installer Qualifications: Minimum two years experience in erecting covers/canopies of the type specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Follow manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Perfection Architectural Systems, Inc., 2310 Mercator Drive Orlando, FL 32807; ASD. Tel: (800) 238-7207, Fax: (407) 671-8252.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

C. Provide all protective covers from a single manufacturer.

2.2 MATERIALS

A. Aluminum Extrusions: 6063 alloy, T-6 temper.

B. Grout: 1-part portland cement, 3 parts masonry sand; 2,000 pounds per square inch (13.8 MPa) compressive strength.

C. Foam Block-Outs: Rigid foam blocks sized as required for column embedment depth and shape.

2.3 COMPONENTS

A. Columns:
   1. Radius-cornered aluminum tubular extrusion as required by structural engineering design.
   2. Grout Key: Provide two 1-1/2-inch (38 mm) diameter holes in column base, one each in opposite sides.
   3. Provide clear acrylic protection coat on surfaces in contact with grout.

B. Beams: Open top aluminum tubular extrusions.
   1. Size: As required by structural engineering design.

C. Deck: Rigid-Roll-Lock extruded aluminum, self-flashing, interlocking sections.
   1. Size and Profile: As required by structural engineering design.
   2. Provide welded endplate water dams where sections terminate at other than drainage channels.

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 (25 mm), self-tapping, Type 18-8 stainless steel with neoprene washers.
   2. Trim Screws: No. 10 by 1/2 inch (13 mm), self-tapping, Type 18-8 stainless steel.
   3. Other Fasteners: Type 18-8 stainless steel, type recommended by manufacturer for specific condition.

2.5 FABRICATION

A. Shop Assembly: Fabricate cross beams and columns into one-piece rigid bents with corners mitered and heli-arc welded to the extent that completed bents can be shipped on local, state, and federal highways without special permit. Provide bolted connections for bents required to be shipped unassembled.

2.6 FINISHES

A. Bents:
   1. Fluoropolymer Coating: 70 percent PVDF resin-based fluoropolymer, AA-C-12C-42R-1, custom color as selected by architect, comply with AAMA 605.
      a. Three coat application.

B. Deck:
   1. Fluoropolymer Coating: 70 percent PVDF resin-based fluoropolymer, AA-C-12C-42R-1, custom color as selected by architect, comply with AAMA 605.
      a. Three coat application.

C. Fascia/Gutter:
   1. Fluoropolymer Coating: 70 percent PVDF resin-based fluoropolymer, AA-C-12C-42R-1, custom color as selected by architect, comply with AAMA 605.
      a. Three coat application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine footings in which bents will be set. Verify footing locations and elevations comply with shop drawings.

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 ERECTION

A. Erect protective covers in accordance with manufacturer's installation instructions.

B. Set bents 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. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from the site.

3.4 PROTECTION

A. Protect finished aluminum surfaces from damage due to subsequent construction operations.

END OF SECTION

SECTION 107516 - GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes ground-set flagpoles made from stainless steel.

B. City-Furnished Material: Flags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles.

1. Include plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.

2. Include section, and details of foundation system.

C. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For flagpoles.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design flagpole assemblies.

B. Seismic Performance: Flagpole assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

C. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.

1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is 180 MPH

2. Base flagpole design on polyester, nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.3 STAINLESS-STEEL FLAGPOLES

A. Stainless-Steel Flagpoles: Cone-tapered flagpoles fabricated from pipe, tube, or plate complying with ASTM A 312/A 312M, ASTM A 269, or ASTM A 666, Type 316L.
   1. American Flag and Pole Company
   2. Morgan-Francis Flagpoles & Accessories
   3. American Flagpole
   4. Pole Tech

B. Exposed Height: 25 feet, 30 feet, and 35 feet.

C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

   1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.

   2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch (1.52-mm) wall thickness with 3/16-inch (4.8-mm) steel bottom plate and support plate; 3/4-inch- (19-mm-) diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.

   1. Flashing Collar: Same material and finish as flagpole.

E. Cast-Metal Shoe Base: Made from steel with finish matching flagpole for anchor-bolt mounting; furnish with anchor bolts.

   1. Furnish ground spike.

2.4 FITTINGS

A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

   1. Halyard Flag Snaps: Chromium-plated bronze swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.

   2. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Furnish two per halyard.
      a. Gettysburg Flag Works
      b. Valley Forge Flag
      c. Anley Flags

2.5 MISCELLANEOUS MATERIALS

A. Non shrink, Nonmetallic Grout: Factory-packaged, no staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

B. Drainage Material: Crushed stone or crushed or uncrushed gravel; coarse aggregate.

C. Sand: ASTM C 33/C 33M, fine aggregate.

D. Elastomeric Joint Sealant: Multicomponent nonsag urethane joint sealant complying with requirements in Section 079200 "Joint Sealants."

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 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. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

E. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.

F. Anchor Bolts: Locate and secure anchor bolts in forms with templates and by tying to reinforcement.

G. Place concrete, as specified in Section 033000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

H. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with non-shrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION

SECTION 108200 – LOUVERED ROOF TOP EQUIPMENT SCREENS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum louvered roof top equipment screens

B. See Division 5 Section "Structural Steel Framing" for structural framing supporting louver sections.

1.2 PERFORMANCE REQUIREMENTS

A. Design: Design louvers, including comprehensive engineering analysis by a qualified engineer, registered in the state of Florida, using structural performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.

1. Wind Loads: Determine loads based on a uniform pressure of 41 lb./sq. ft. (1435 Pa), acting inward or outward.

1.3 SUBMITTALS

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

B. Shop Drawings: For equipment screens and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

D. Submittal: For louvers indicated to comply with structural performance requirements and design criteria indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221M, Alloy 6063-T5.

B. Aluminum Sheet: ASTM B 209M, Alloy 3003 with temper as required for forming.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

2.2 FABRICATION, GENERAL

A. Join concealed frame members to each other and to fixed louver blades with fillet 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.

2.3 EXTRUDED-ALUMINUM ROOF TOP EQUIPMENT SCREEN

A. Horizontal Blade Louvered Roof Top Equipment Screen

1. Basis-of-Design Product: Architectural Louvers Co. (Harray, LLC); Model V2KSD. Subject to compliance with requirements, provide the specified product or comparable product by one of the following:

    a. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.

2. Louver Blade Depth: 2 inches (50 mm)

3. Blade Profile: Plain blade with center baffle.

4. Blade Nominal Thickness: Not less than 0.063 inch (1.6 mm).

5. Frame Nominal Thickness: Not less than 0.080 inch (2.03 mm)

6. Framing Support: Modular aluminum tube framing, not less than 0.140-inch thickness. Design and construction of framing and connections to handle design wind loads. Framing to mount directly to air handling unit as shown on drawings.

7. Hinge: 0.120" thickness aluminum heavy-duty hinge. Each louver panel to be hinged for full access to the air handling unit.

8. Latch: top and bottom slam latch (provided)

9. Louver Performance Requirements:

    a. Free Area: Not less than 8.0 sq. ft. (0.74 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver assembly.

    b. Horizontal Drag Coefficient: Not greater than 0.66 on a cross sectional profile, allowing for a 34% reduction in wind load imposed horizontally upon supporting structural framing.

2.4 ALUMINUM FINISHES

A. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place equipment screens 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 weather-tight connection.

C. Provide perimeter reveals and openings of uniform width to allow for thermal expansion, as indicated.

D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.

END OF SECTION

SECTION 114000 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. The work referred to in this section consists of furnishing all labor and material required to provide and deliver all equipment hereinafter specified into the building, uncrate, assemble, hang, set in place, level, and completely install, exclusive of final utility connections.

B. Coordinate but do not install (unless specifically directed to do so in the technical specifications) City and Vendor-supplied equipment noted on the drawings or in the specifications as NIKEC. Show on roughing in plans the sizes, utilities, and other requirements as furnished in the Specifications, by City or appropriate supplier in submittals as if the equipment is contractor furnished.

C. Coordinate and show sizes, utilities, and other requirements as determined by physical inspection for equipment noted as existing to be reused. Include costs for marking, removing, storing, cleaning, redelivering and installing such equipment. All requirements within the project manual apply to reused equipment except warranty as if contractor furnished including but not limited to code compliance and accessories necessary to conform with the new application.

D. Should there be any discrepancies or inconsistencies that occur between the foodservice drawings and specifications, request written clarification; provide the better quality, and the greater quantity of work or material without any additional costs to the City. The kitchen equipment contractor is responsible for any costs incurred by failure to clarify any conflicting requirements.

E. Secure and pay fees for permits, test, and inspections required by all authorities having jurisdiction and directly related to the construction and installation of the 11 40 00 foodservice equipment work.

1.2 RELATED SECTIONS / WORK IN THE MECHANICAL AND ELECTRICAL DIVISIONS:

A. Refer to the mechanical/plumbing divisions regarding mechanical services including, but not limited to, all water, gas, and steam rough-ins, pressure regulating valves, check valves, shut-off valves, grease traps, steam traps, drain traps, vents, valves, floor sinks, faucets, drains, floor drains, duct work, pipes and pipe fittings, and all other materials required to complete final connections to the foodservice equipment. Additional work not included in the 114000 scope; G.C. to coordinate and provide:

1. Hood and ventilator duct work and fans upstream from the connection positions

2. Installation of floor troughs, including set-in place and final connections.

B. Refer to the electrical divisions regarding electrical services including, but not limited to, all electrical rough-ins, standard and low voltage wiring, drop cords, disconnects, breakers, shunt trip breakers, and all other materials required to complete final connections to the foodservice equipment. Additional work not included in the 114000 scope; G.C. to coordinate and provide:

1. Installation of the light fixtures furnished loose for the walk-in coolers/freezers
2. Wiring of the exhaust hood controls including, but not limited to, all low voltage interconnections.
3. Connection of hood fire suppression system building alarm system
4. Connection of walk-in cooler/freezer temperature alarm system to the building alarm system.

C. Additional work not included in the 114000 Section Additional work not included in the 114000 scope; G.C. to coordinate and provide:

1. Slab depressions for walk-in coolers/freezers, floor troughs, and other applicable foodservice equipment.
2. Wall backing to support wall mounted foodservice equipment
3. Concrete pads for outdoor equipment such as refrigeration racks, compressors, etc.
4. Roof rails, roof curbs, pitch pockets, coring, flashing, and fire stopping required for roof top foodservice equipment and related refrigeration piping.

1.3 SUBMITTALS

A. Upon award of Contract, furnish the Architect with reproducible copies of the following drawings, in accordance with the approved project schedule, which shall be made on sheets equal in size and matching the bid set drawing size. Reproduced copies of bid documents will not be accepted for this purpose in any fashion.

1. Equipment specified for fabrication shall be detailed and fully dimensioned to a minimum scale of 3/4" = 1'-0" (1:20) for plan and elevation views and 1-1/2" = 1'-0" (1:10) for sections.
2. Prepare separate electrical and mechanical dimensioned rough-in drawings at 1/4" = 1'-0" (1:50) showing exact point of penetration of floors, walls, and ceilings for all services required to operate the equipment that the Contractor shall furnish, including the requirements for Contractor supplied and installed refrigerant and beverage piping line runs. These drawings shall also show exact locations of final connections to equipment. Indicate floor drains, floor sinks, receptacles, lights, and other special conditions related to the equipment known to the Contractor but provided under other Sections.
3. Dimensioned drawings shall be submitted showing the location and size of all bases, depressions, grease interceptors, special height walls, openings in walls for equipment or operations, and critical dimensions, etc. Drawings shall be drawn to a scale of not less than 1/4" = 1'-0" (1:50).

B. Manufacturers' Data: Upon award of Contract, submit bound copies of Manufacturers' Illustrations and Technical Data to the Architect for review prior to procurement. Items of Standard Manufacture shall be submitted, including items purchased to be built into fabricated equipment. Each illustration shall be marked to describe accurately the item to be furnished as specified, including voltage, phase, load, accessories, etc.

C. Manufacturers' List: Submit in writing a list of all manufacturers' representatives of the foodservice equipment, such as convection ovens, ranges, etc., and their authorized service agencies' addresses and telephone numbers.

D. Foundation Data: Data and drawings shall be submitted for each item, if any, requiring special foundations, structures, or supports. Such foundations, structures, or supports will be provided and installed by other appropriate trades in accordance with the drawings and specifications which shall be provided by the Contractor and reviewed by the Architect.

E. Operation and Maintenance Manuals: Provide three bound copies of operation, maintenance, and parts manuals for all equipment items of standard manufacture including standard component assemblies built into all custom-fabricated items.

F. Review by the Architect of the drawings and brochures submitted by the Contractor does not waive the responsibility of the Contractor to furnish each item of equipment in complete compliance with the specifications and contract drawings.

G. The number of copies of all submittals shall be as determined by the Architect.

H. Samples: Samples of materials, products, and fabrication methods shall be submitted for review at no additional cost, before proceeding with the work.

1.4 QUALITY ASSURANCE

A. Standard Products: Materials, products, and equipment furnished under this contract shall be the standard items of manufacturers regularly engaged in the production of such materials, products, and equipment and shall be of the manufacturers' latest design that complies with the specifications.

B. Manufacturers' Qualifications: Manufacturers shall be regularly engaged in the production of the items furnished and shall have demonstrated the capability to furnish similar equipment that performs the functions specified or indicated herein.

C. Installation Qualifications: Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work defined in this Section.

D. Coordination of Work: Coordinate work with the respective trades performing preparatory work for installation of equipment under this Contract, including, but not limited to: construction of pits, trenches, receptors; rough-in of supply, waste and vent piping; electrical connections; and field verification of dimensions.

E. Product Options: Drawings indicate foodservice equipment based upon equipment specified herein. All substitutions shall be in compliance with the requirements in Division 1 (or Section I if appropriate.).

F. Conflict: Where written specifications and drawings conflict or appear to conflict, request clarification. Prior to receiving clarification use the greater quality or greater quantity.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver foodservice equipment in containers designed to protect equipment and finish until final installation. Make arrangements to receive equipment at project site at a time and place agreed with the General Contractor. If the site is not ready for delivery, then either delay delivery or arrange to hold in a secure and protected warehouse until delivery can be made to job site.

B. Store foodservice equipment in original containers and in location to provide adequate protection to equipment while not interfering with other construction operations. Coordinate with other trades so that worktables, serving counters and equipment are not used for scaffolding or as workbenches.

C. Handle foodservice equipment carefully to avoid damage to components, enclosures, and finish. Do not install damaged foodservice equipment; replace and return damaged components to equipment manufacturer.

1.6 APPLICABLE CODES AND STANDARDS

A. Except as otherwise indicated, each item of equipment shall comply with the latest current edition of the following standards as applicable to the manufacture, fabrication, and installation of the work in this section. Comply with all Federal, State, and Municipal regulations and notifications which bear on the execution of this work. Call to the attention of the City in writing any design conflict with the requirements of the Americans with Disabilities Act (ADA) during Bid Process so resolution can be effected prior to Contract Award.

1. NSF Standards: Comply with applicable National Sanitation Foundation standards and criteria and provide NSF "Seal of Approval" on each manufactured item and on major items of custom-fabricated work.

2. UL / ETL / CSA Standards: For electrical components and assemblies, provide either UL / ETL / CSA listed products or, where no listing service is available, provide a complete index of the components used as selected from the UL / ETL / CSA "Recognized Component Index." For fire extinguishing systems comply with UL 300.

3. ANSI Standards: Comply with applicable ANSI standards for electric-powered and gas-burning equipment; for piping to compressed-gas cylinders; and for plumbing fittings, including vacuum breakers and air gaps, to prevent siphonage in water piping.

4. AGA / CGA: All gas-fired equipment shall be AGA / CGA approved, equipped to operate on the type gas available at the job site, and shall contain 100% automatic safety shut-off devices.

5. NFPA Standards: Comply with NFPA Bulletin 96 for exhaust systems; with NFPA Bulletins 13, 17, 17A and 96 for fire extinguishing systems; and with NFPA 54, National Fuel Gas Code and NFPA 70, National Electrical Code.

6. ASME Code: Comply with ASME boiler code requirements for steam-generating and steam-heated equipment; provide ASME inspection, stamps, and certification of registration with National Board.

7. SMACNA Guidelines: Provide seismic restraints for food service equipment to comply with the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Kitchen Equipment Fabrication Guidelines", appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment", unless otherwise indicated.

8. ASHRAE: Provide mechanical refrigeration systems complying with the American Society of Heating, Refrigerating and Air Conditioning Engineers' ASHRAE 15, "Safety Code for Mechanical Refrigeration".

1.7 PROJECT CONDITIONS

A. Visit the job site to field check actual wall dimensions and roughing-in and be responsible for furnishing, fabricating, and installing the equipment in accordance with the available space and utility services as they exist on the job site for an accurate fit.

B. Check all door openings, passageways, elevators, etc., to be sure that the equipment can be conveyed to its proper location within the building and, if necessary, check with the Contractor regarding the possibility of holding wall erection, placement of doorjambs, windows, etc., for the purpose of moving the equipment to its proper location. Any removal and rebuilding of walls, partitions, doorjambs, etc., necessary to place the equipment or, if caused by incorrect information on the Contractor's drawings, shall be done at the expense of the Contractor.

C. Physically check the location and utility size of all "rough-ins" at the job site for compatibility with the equipment being installed before finished floors, walls, and/or ceilings are in place.

D. Check electrical characteristics and water, steam, and gas pressure. Provide pressure-regulating valves where required for proper operation of equipment.

1.8 GUARANTIES AND WARRANTIES

A. Self-contained or remote refrigeration systems furnished under this Contract shall be provided with start-up and a one-year service contract providing free service, 24 hours per day, seven days per week, including parts and labor. Hermetic or semi-hermetic compressors shall be covered by the manufacturers' factory warranty for an additional four years. Other equipment provided shall include a one-year warranty covering parts and labor, plus any extended warranties as normally provided by individual manufacturers. Equipment including refrigeration systems both self-contained and remote shall be warrantied by the Contractor on the project for one year as indicated in the preceding sentence. The first day of the first year commences upon the issuance of a certificate of occupancy for each area.

PART 2 - PRODUCTS

2.1 GENERAL

A. The equipment and its component parts shall be new and unused. All items of standard manufactured equipment shall be current models at the time of delivery. Parts subject to wear, breakage, or distortion shall be accessible for adjustment, replacement, and repair.

B. Means shall be provided to ensure adequate lubrication for moving parts. Oil holes, grease fittings, and filler caps shall be accessible without the use of tools.

C. The design of the equipment shall be such as to provide for safe and convenient operation. Covers or other safety devices shall be provided for all items of equipment presenting safety hazards. Such guards or safety devices shall not present substantial interference to the operation of the equipment. Guards shall provide easy access to guarded parts.

D. Trim shall not be an acceptable substitute for accuracy and neatness. When trim is required and accepted by Architect in lieu of rejection of items of equipment, it shall be the Contractor's responsibility to provide same at no additional cost.

E. Unless otherwise specified herein, no material lighter than #20 gauge shall be incorporated into the work. Gauges for sheet iron and sheet steel shall be U.S. Standard Gauges and finished equipment gauge thickness shall not vary more than 5% plus or minus from the thickness indicated below.

GAUGE	THICKNESS	GAUGE	THICKNESS
#10	0.1406" (3.0mm)	#16	0.0625" (1.6mm)
#12	0.1094" (2.5mm)	#18	0.0500" (1.25mm)
#14	0.0781" (2.0mm)	#20	0.0375" (1.0mm)

F. Materials or work described in words which have a well-known and accepted technical or trade meaning shall be held to refer to such accepted meanings.

2.2 MATERIALS

A. Submit a certified copy of the mill analysis of materials if requested by the Architect.

B. Stainless steel sheets shall conform to American Society for Testing and Materials (ASTM) specification A240, Type 304 Condition A, 18-8, having a No. 4 finish. A No. 2B finish shall be acceptable on surfaces of equipment not exposed to view. Sheets shall be uniform throughout in color, finish, and appearance.

C. Stainless steel tubing and pipe shall be Type 304, 18-8, having a No. 4 finish, and shall conform to either ASTM A213 if seamless or ASTM A249 if welded.

D. Rolled shapes shall be of the cold-rolled type conforming to ASTM A36.

E. Galvanized sheet steel shall conform to ASTM A526; where extensive forming to take place, conform to ASTM A527; conform to ASTM A525, coating designation G115, chemical treatment.

F. Galvanized steel sheets shall be cold-rolled, stretcher leveled, bonderized, and rerolled to ensure a smooth surface.

G. Castings shall be corrosion-resisting metal containing not less than 30% nickel. Castings shall be rough ground, polished, and buffed to bright luster and free from pit marks, runs, checks, burrs, and other imperfections. In lieu of corrosion- resisting metal castings, die-stamped or cast 18-8 stainless steel will be acceptable.

H. Millwork materials shall be free from defects impairing strength, durability, or appearance; straight and free from warpage; and of the best grade for their particular function. Wood shall be well seasoned and kiln dried and shall have an average moisture content of 8%, a maximum of 10%, and a minimum of 5%.

1. Plywood and other woodwork of treatable species, where so required by the code, shall be fire-retardant treated to result in a flame spread rating of 25 or less with no evidence of significant progressive combustion when tested for 30 minutes duration under ASTM E84 and shall bear the testing laboratory mark on a surface to be concealed.

2. Concealed softwood or hardwood lumber shall be of poplar, Douglas fir, basswood, red oak, birch, maple, beech, or other stable wood and shall be select or better grade, unselected for color and grain, surfaced four sides, square-edged, and straight. Basswood may be used where fire-retardant treated materials are required.

3. Plywood for transparent finish shall conform to U.S. Product Standard PS-51-71, Type I (fully waterproofed bond), with architectural grade face veneers of species as specified, free of all pin knots, patches, color streaks and spots, sapwood, and other defects. Plywood designated to have plywood cores shall be of either 5 ply or 7 ply construction. Plywood so designated on the drawings and plywood not otherwise shown shall have a particle board core, cross banding of veneers, and face and back veneers. Particle board cores shall have a 45-pound density, except where the fire-retardant treatment requires cores of lesser density.

4. Face veneers shall be matched for color and grain to produce balance and continuity of character. Mineral streaks and other discolorations, worm holes, ruptured grain, loose texture, doze, or shake will not be permitted. Face veneer leaves on each surface shall be full-length, book matched, center matched, and sequence matched. Surfaces shall be sequenced and blueprint matched. Veneers not otherwise indicated shall be plain sliced. Backing veneers for concealed surfaces shall be of a species and thickness to balance the pull of the face veneers.

5. Hardwood plywood for painted surfaces shall conform to U.S. Product Standard PS-51-71, Type I, and shall have sound birch, maple, or other approved close grain hardwood faces suitable for a paint finish.

6. Perforated hardboard shall be a tempered hardboard, 1/4" (6 mm) thick, conforming to Federal Specification LLL-B-810B, Type I, SIS, Finish B (primed), Design B (perforated), with ¼" (6 mm) diameter holes spaced on 1" (25 mm) centers both ways.

7. Plastic laminate surfaces shall be laminated with thermosetting decorative sheets of the color, pattern, and style as selected by the Architect. Horizontal surfaces shall be laminated with sheets conforming to Federal Specification L-P-508F, Style D, Type I (general-purpose), Grade HP, Class 1, 1/16" (2 mm) thick, satin finish, with rough sanded backs. Vertical surfaces shall be laminated with sheets conforming to Federal Specification L-P-598F, Style D, Type II, (vertical surface), Grade HP, Class 1, non-forming, satin finish, 1/32" (1 mm) thick or heavier. Surfacing for curved surfaces shall be laminated from sheets conforming to Federal Specification L-P-508F, Style D, Type III (post-forming), Grade HP, Class 1, satin finish. Balance sheets for backs in concealed locations shall be either reject material of the same type and thickness as the general-purpose grade facing or may be .020" (0.5 mm) thick laminate backing sheets conforming to Federal Specification L-P-00508E, Style ND, Type V (backing sheet), Grade HP.

8. Adhesive for application of plastic laminate to wood substrates of counter tops shall be a phenolic, resorcinol, or melamine adhesive conforming to Federal Specification MMM-A-181C and producing a waterproof bond. Adhesive for applying plastic laminate to vertical surfaces shall be either a waterproof type or a water-resistant type such as a modified urea- formaldehyde resin liquid glue conforming to Federal Specification MMM-A-188C. Contact adhesive will not be acceptable.

9. Plywood for laminate assemblies shown or specified with plywood core shall be of the 5 or 7 ply construction with sanded close-grain hardwood face and back veneers, laminated with waterproof glue, in thickness shown, conforming to U.S. Product Standard PS-51-71. Particle board for plastic laminate assemblies shown

or specified with particle board wood core shall conform to U.S. Products Standard CS-236-66, Type 1 or 2, Grade B (45-pound density), Class 2; except where fire-retardant treatment is required, the density shall conform to the treatment requirements.

I. Sealant: ASTM C 920; type S, Grade NS, Class 25, use, NT. Provide elastomeric sealant, NSF certified for end use application indicated. Provide sealant that, when cured and washed, meeting requirements of Food and Drug Administration's 21 CFR, Section 177.2600 for use in areas that come in contact with food. Dow-Corning #780 or General Electric "Silastic" or approved equal in either clear or approved color to match surrounding surfaces and applied in accordance with sealant manufacturers' recommendations for smooth, sealed finish.

J. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), Class 1 (clear), Quality q3 (glazing select). Provide products complying with ANSI Z97.1, manufactured by horizontal (roller hearth) process and ¼" (6 mm) thick, unless otherwise indicated. Provide exposed safety edges, if any, seamed before tempering.

K. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound deadening coating. Provide coating compounded for permanent adhesion to metal in 1/8" (3 mm) thickness that does not chop, flake, or blister.

2.3 FINISHES

A. Paint and coatings shall be of an NSF approved type suitable for use in conjunction with foodservice equipment. Such paint or coating shall be durable, non-toxic, non-dusting, non-flaking, and mildew resistant; shall comply with all governing regulations; and shall be applied in accordance with the recommendations of the manufacturer.

B. Exterior, galvanized parts, exposed members of framework, and wrought steel pipe where specified to be painted shall be cleaned, properly primed with rust-inhibiting primer, degreased, and finished with two (2) coats of epoxy-based grey hammertone paint, unless otherwise specified.

C. Stainless steel, where exposed, shall be polished to a #4 commercial finish. Where unexposed, finish shall be #2B. The grain of polishing shall run in the same direction wherever possible. Where surfaces are disturbed by the fabricating process, such surfaces shall be finished to match adjacent undisturbed surfaces.

D. Galvanized shelving shall not be painted.

E. Fabricated equipment shall be spray coated with plastic suitable for protecting the equipment during transport and installation. The coating shall be easily removable and shall be removed after the equipment installation is complete at the work site or, alternatively, when directed by the Architect.

F. Exposed surfaces on brass, bronze, or steel shall be plated with chromium over nickel in accordance with Federal Specifications WW-P-541, Paragraph 9.5 and Table 9.4, unless otherwise specified.

2.4 ELECTRICAL AND MECHANICAL REQUIREMENTS

A. Standard UL / ETL / CSA listed materials, devices, and components shall be selected and installed in accordance with NEMA Standards and recommendations and as required for

safe and efficient use and operation of the foodservice equipment without objectionable noise, vibration, and sanitation problems.

1. Provide recognized commercial grade signals, "on-off" pushbuttons or switches, and other speed and temperature controls as required for operation of each item, complete with pilot lights and permanent engraved, plastic laminate signs and graphics identifying each item. Provide stainless steel cover plates at controls and signals.

2. Each item requiring electrical power shall be equipped with either a terminal box for permanent connection or with cord and plug for interruptible connection, as indicated. Provide NEMA standard grounding type plugs, where used.

3. Furnish foodservice equipment completely wired internally using wire and conduit suitable for a wet location, including a separate grounding wire. Provide electrical outlets and receptacles required to be mounted on or in fabricated equipment and interconnect to a suitable terminal box (subpanel, starter, or disconnect switch if so specified) with all wires neatly tagged showing item number, voltage characteristics, and load information.

4. Receptacles for all wall- and floor-mounted outlets will be provided to be used for plug-in equipment with characteristics as noted on the drawings. Provide Hubbell three-wire or four-wire grounding-type connectors and neoprene cords installed on each item of plug-in equipment to match receptacles provided.

5. Electrically heated equipment shall be internally wired to a thermostatic control and an "on-off" red neon light indicator, which shall be mounted in a terminal box on a removable stainless steel access panel.

6. Only rigid steel zinc-coated conduit shall be used, painted to match adjacent surfaces where exposed. Wiring shall be run concealed wherever possible.

7. Provide on, or for, each motor-driven appliance or electrical heating or control unit, a suitable control switch or starter of the proper type and rating.

8. Appliances shall be furnished complete with motors, driving mechanism, starters, and controllers, including but not limited to, master switches, timers, cut-outs, reversing mechanism, and other electrical equipment if and as applicable. Wiring and connection diagrams shall be furnished with electrically operated machines and for electrically wired fabricated equipment.

9. Appliances shall be of rigid construction, free from objectionable vibration. Quietness of operation of all foodservice equipment is a requirement. Remove or repair any equipment producing objectionable noise and/or vibration as directed by the Architect.

10. Motors shall be of the drip-proof, splash-proof, or totally enclosed type, having a continuous duty cycle and ball bearings, except small timing motors which may have sleeve bearings. Motors shall have windings impregnated to resist moisture. Motors located where subject to deposits of dust, lint, or other similar matter from the machine on which installed shall be of the totally enclosed type. Motors shall have ample power to operate the machines for which designated under full load operating conditions without exceeding their nameplate ratings. Horsepower requirements on driven equipment shall be determined by the

manufacturer based on normal operation at maximum capacity. The nominal rated motor horsepower shall be not less than the horsepower required for normal operation of the equipment at maximum capacity. Insulation shall be NEMA Class B, or better.

11. Cover plates shall be furnished and installed for all electrical outlets, receptacles, switches, etc., to match the material and finish of the equipment to which they will be -fastened.

12. Switches, controls, etc., shall be conspicuously labeled as to use with plastic nameplates secured to the adjacent surface as previously specified in Article 2.01-C. Submit a sample for approval if requested by Architect.

13. Where specified for custom fabricated equipment, provide compartment with electrical sub-panel which shall be pre-wired in conduit concealed in cabinet body construction and connected to all electrical components built into or set upon the counter. Electrical sub-panel shall be UL / ETL / CSA listed, 3-phase, 4-wire circuit breaker type with a ground buss main breaker and individual breakers for each serviced load. Buss shall be copper, and the circuit breakers shall be the molded case, bolt-on type with thermomagnetic quick-make, quick-break trip. Multi-pole circuit breakers shall have an internal trip bar. The circuit breakers shall have an interrupting capacity of 10,000 amperes at 120 volts and there shall be a separate breaker for each connected load. Each breaker shall be sized for 125% of the connected load and a minimum of two (2) extra, single pole, 20-amp circuit breakers shall be provided. The loads shall be connected through the breakers in a phased sequence to balance the load on each phase.

B. Water inlets shall be located above the positive water level wherever possible to prevent siphoning of liquids into the water supply system. Wherever conditions shall require a submerged inlet, a suitable type of check valve (except in jurisdictions where check valves are prohibited) and vacuum breaker shall be provided with the fixture to prevent siphoning. Where exposed, piping and fittings shall be chrome-plated. Where vacuum breaker piping is through equipment, provide chrome -plated escutcheon plates to cover holes.

1. Provide and install indirect waste lines from equipment which will discharge into floor drains or safe wastes, chrome-plated where exposed. Extend to a point at least 1" (25 mm) (or as required by local or state code) above the rim of the floor drain, cut bottom on 45-degree angle and secure in position.

2. Horizontal piping lines shall be run at the highest possible elevation and not less than 6" (150 mm) above the floor, through equipment where possible.

3. No exposed piping in or around fixtures or in other conspicuous places shall show tool marks or more than one thread at the fitting.

4. Steam operating valves on or in fabricated and purchased foodservice equipment shall be provided with composition hand wheels, which shall remain reasonably cool in service.

5. Provide suitable gas and liquid pressure-reducing valves for equipment with such components that might reasonably be expected to be affected over a period of time by adverse pressure conditions, including but not limited to dishwashers, booster heaters, coffee urns, ranges, steam boilers, etc.

C. Provide and install complete refrigeration systems--charged, started, and operating properly including, but not limited to:
compressors, condensers, racks, coils, vibration eliminators, sight glasses (moisture indicating type), expansion valves, filters, oil separators, thermostats, defrost time clocks, all controls and control wiring, liquid line driers, piping, and refrigeration grade copper tubing with all sweat joints using Safety-Silv No. 1200 or approved equal silver solder (with as few joints as possible)

1. Where specifications call for pre-piped lines (i.e., from a fixture to a valve compartment, etc.), provide such work in strict conformance with other sections of the specifications which set forth standards for this type of work or in conformity with the requirements of the ASHRAE Standards or local authorities, whichever is the greater.

2. Mechanically refrigerated cold pans shall have a normally closed liquid line electric solenoid valve installed before the expansion valve and wired to a silent-type toggle switch complete with an "on-off" red neon light indicator and both mounted in a terminal box on a removable access panel. This switch shall be fed by a separate control circuit and shall not to be wired into the compressor circuit so that it shall stop the flow of refrigerant to the cold pan and not turn off the compressor. The compressor shall then pump down and turn off through the action of the pressure control.

3. Each refrigeration item specification is written to provide minimum specifications and scope of work. Refrigeration equipment shall be designed and installed to maintain the following general temperatures unless otherwise specified.

a.	Walk-In Refrigerators	1.7°C / 35°F
b.	Walk-In Freezers	-23.3°C / -10°F
c.	Reach-In Refrigerators	1.7°C / 35°F
d.	Reach-In Freezers	-23.3°C / -10°F
e.	Undercounter Refrigerators	1.7°C / 35°F
f.	Undercounter Freezers	-23.3°C / -10°F
g.	Cold Pan	-17.8°C / 0°F
h.	Work Rooms	10°C / 50°F

4. Provide electrical and refrigeration components needed by the completed system and complete all refrigeration and control connections of and to said components.

5. Provide evaporator coil defrost system on all walk-in refrigerator and freezer rooms where the refrigeration systems are designed to operate at room temperature of less than 35°F (1.7°C).

6. Verify the requirements of and provide any or all additional refrigeration specialty(s) or component(s) required or recommended by the manufacturer for proper operation under the specific operating conditions and location of each system specified.

7. Verify and provide manufacturer's certification (or certification by manufacturer's authorized agent) that the equipment selection hereinafter specified for each refrigeration system is properly sized and shall meet the operating requirements set forth for each system regarding maintaining specified operating temperature, hours of compressor running time, and system pressures and velocities as recommended by the equipment manufacturer(s).

8. During check-out and initial operation, verify that:

   a. Controls are properly adjusted.

   b. Condensers are equipped with an overload protector.

   c. A competent service mechanic is on site during the first eight (8) hours of operation.

   d. Switches, starters, and controls are identified as to function.

9. Unless otherwise specified, furnish thermometers for walk-in units mounted above the exterior entrance door with suitable length armored capillary tubes to allow the sensing bulbs to be installed in the incoming air stream to the blower coil with runs fastened to the walk-in walls to prevent it from damage. This identical requirement applies to alarm systems when specified.

2.5 PRODUCT SPECIFICATIONS

A. Refer to Part 4 for complete itemized product specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Begin installing the equipment at the time the building is ready to receive the equipment and in accordance with the schedule.

B. Provide a competent foreman or supervisor for erection of equipment and to coordinate with other trades regarding connections, installation, and inspection. Coordinate delivery schedule to ensure adequate openings in the building to receive the equipment.

C. Install refrigeration work in an approved manner, using first quality fittings, controls, valves, etc. Refrigeration items shall be started up, tested, adjusted, and turned over to the Architect in first-class condition and left operating in accordance with the manufacturer's specifications.

D. Set equipment that rests on masonry bases level onto a bed of silicone rubber sealant.

E. Seal equipment that butts to a wall or against other equipment with silicone rubber sealant. Set trim strips or other items requiring fasteners in a bed of silicone rubber sealant and fastened with suitable stainless steel fasteners 48" (1200mm) or less on centers. , surfaces shall be thoroughly clean and degrease all surfaces prior to the application of sealant.

F. Install and interconnect electrical controls, switches, or other units which are separately furnished for field installation in or on equipment provided, unless otherwise specified.

G. Install and wire refrigeration systems in strict conformance with the manufacturers' instructions and recommendations. Ensure that all refrigeration condensing units are ventilated properly and are accessible for repair, maintenance, and inspection.

H. Hang evaporator coils per the manufacturer's recommendation at the locations as shown on the drawings. Mount units such that the drain pans are pitched to the drain lines. Hang the coils using nylon or other approved non-conductive, non-corrosive fasteners Furnish #12-gauge galvanized steel fish plates of suitable size and shape on the exterior ceiling of the walk-in to spread the weight of the coils adequately. Connect coils to the condensing unit and install to constitute a complete working system capable of maintaining the interior temperatures specified regardless of the heavy usage the walk-in units may receive.

I. Furnish and install a copper or PVC drain line painted silver from each coil outlet to a point 1" (25mm) above the floor drain. Trap drain lines immediately above the floor drain. Provide continuous electrified heater tape for freezer drain lines, coordinate electrical requirements and wiring with electrical division. Insulate drain line after installation.

J. Refrigeration tubing shall be the Type L, ACR hard drawn degreased, sealed copper and shall be installed with horizontal runs sloped 1" per 20 feet (1:240) toward the condensing units. Refrigerant piping shall be properly supported by adjustable hangers spaced and adjusted to the drop required. Where vertical runs of more than 5' (1500mm) occur in the suction line, trap the risers at the bottom. Install piping so that refrigerant or oil cannot drain back into the coils from the suction line.

K. Insulate suction and refrigerant lines with minimum 1/2" (13mm) Armstrong armaflex or equal cellular type insulation. Provide metal pipe sleeves where piping passes through a wall, ceiling, or floor. Fill space around the tubing with mastic insulating compound. Install a permanent suction line filter in each compressor suction line with pressure fitting ahead of the filter to facilitate checking of pressure drop through the filter. Fully insulate and seal penetrations through walk-in cooler or freezer structures to be vapor tight to prevent condensation within any light fixtures, switch boxes, junction boxes, or any other fittings. Fully seal refrigeration and drain lines and provide escutcheon plates.

L. Furnish and completely install a thermostat to control the refrigeration temperatures for each individual compartment.

M. Mount the condensing units on a welded steel rack containing all accessories and components necessary to form a complete condensing unit package. Provide each condensing unit with a factory mounted, pre-wired control panel/disconnect switch complete with circuit breakers, contactors, and time clocks as required.

N. Furnish the refrigeration systems with a one-year refrigeration service contract, covering all parts and labor, with service available seven days per week, 24-hours per day. Provide an option for continuation of the service contract after the first year. Warrant the refrigeration system for one year and provide the compressors with the manufacturer's extended five-year warranty.

O. Furnish four (4) copies of complete remote refrigeration system control wiring and piping diagrams. Frame one (1) copy in Plexiglas and mount at compressor location or inside the refrigeration system enclosure as appropriate.

P. Coordinate the equipment work with the respective work of other Sections so that electrical and mechanical components built into the equipment will conform and/or adapt to the type, materials, and characteristics of the building components.

Q. Install heated and motor-driven equipment so as to operate efficiently. Provide additional vents, guards, deflectors, and other accessories as needed at no additional cost. Note such additions or modifications on the shop drawings and bring to Architect's attention by special accompanying letter.

3.2 FABRICATION

A. Items of fabricated equipment shall be fabricated in the same factory and shall be similar in construction details, materials, methods, and appearance to similar types of items so fabricated under this contract.

B. Each fabricated item of equipment shall include necessary reinforcing, bracing, and welding with the proper number and spacing of uprights and cross members for strength. Wherever standard sheet sizes will permit, the tops of all tables, shelves, exterior panels of cabinet type fixtures, and doors and drainboards shall be constructed of a single sheet of metal. Except where required to be removable, flat surfaces shall be secured to vertical and horizontal bracing members by welding or other approved means to eliminate buckle, warp, rattle, and wobble. Equipment not braced in a rigid manner, and which is subject to rattle and wobble shall be unacceptable, and the Contractor shall add additional bracing in an approved manner to achieve acceptance.

C. Suitable pipe slots shall be provided on fabricated equipment to accommodate service and utility lines and mechanical connections. These slots shall be of proper size and shall be neatly made with turned up edges around to eliminate cutting or defacing of equipment on the job. Cabinet bases shall be provided with an inner panel duct at the ends or rear of the cabinet allowing adequate space to conceal vertical piping. Such work, when performed at the job site, shall be of the same quality as similar work performed in the shop.

D. Exposed surfaces shall be free from bolt and screw heads. When bolts are required, they shall be of the concealed type and be of similar composition as the metal to which they are applied. Where bolt or screw threads on the interior of fixtures are visible or may come into contact with hands or wiping cloths, they shall be capped with a stainless-steel acorn nut and stainless steel lock washer.

E. Where screw threads are not visible or readily accessible, they shall be assembled with stainless steel lock washers and nuts. Wherever bolts or screws are welded to the underside of trim or tops, the reverse side of the weld shall be finished uniformly with the adjoining surfaces. Depressions at these points shall not be acceptable.

F. Rivets shall not be permitted in any location.

G. Welding shall be the heliarc method with welding rod of the same composition as the sheets or parts welded. Welds shall be complete, strong, and ductile with excess metal ground off and joints finished smooth to match adjoining surfaces. Welds shall be free of mechanical imperfections such as gas holes, pits, cracks, etc., and shall be continuously welded so that the fixtures shall appear as one-piece construction. Butt welds made by spot solder and finished by grinding shall not be acceptable.

1. Spot welds shall have a maximum spacing of 3" (75mm). Tack welds shall be of at least 1/4" (6mm) length of welding material at a maximum space of 4" (100mm) from center to center. Weld spacing at the ends of the channel battens shall not exceed 2" (50mm) centers.

2. In no case shall soldering be accepted.

3. Fixtures shall be shop fabricated of one piece and shipped to the job completely assembled wherever possible. Equipment too large to transport or enter the building as one piece shall be constructed so that the field joints can be welded at the job site.

4. Exposed joints shall be ground flush with adjoining material and finished to harmonize therewith. Whenever material has been depressed by a welding operation, such depression shall be suitably hammered and peened flush with the adjoining surface and, if necessary, again ground to eliminate low spots. In all cases, the grain of rough grinding shall be removed by successive fine polishing operations.

5. Unexposed welded joints on undershelves of tables or counters in stainless steel construction shall be suitably coated at the factory with an approved metallic-based paint.

6. After galvanized steel members have been welded, welds and areas where galvanizing has been damaged shall have a zinc dust coating applied in conformance with U.S. Government Military Specification Number MIL-P-26915.

H. Butt joints and contact joints, wherever they occur, shall be close fitting and shall not require filler. Wherever break bends occur, they shall be free of undue extrudence and shall not be flaky, scaly, or cracked in appearance; where such breaks do mar the uniform surface appearance of the material, such marks shall be removed by suitable grinding, polishing, and finishing. Wherever sheared edges occur, they shall be free of burrs, fins, and irregular projections and be finished to obviate danger of cutting or laceration when the hand is drawn over them. In no case shall overlapping materials be acceptable where miters or bullnosed corners occur.

I. The grain of polishing shall run in the same direction on horizontal and on vertical surfaces of each item of fabricated equipment except in the case where the finish of the horizontal sections of each shall terminate in a mitered edge. Where sinks and adjacent drainboards are equipped with backsplash, the grain of polishing shall be consistent in direction throughout the length of the backsplash and sink compartment.

J. Component parts, whether fabricated by the Contractor or purchased for building into the fabricated equipment, shall conform to the following.

K. Bolts, screws, nuts, and washers shall be of steel, except where brass or stainless steel is fastened, in which case they shall be of brass or stainless steel, respectively. Where dissimilar metals are fastened, bolts, screws, nuts, and washers shall be of the higher-grade metal. The spacing and extent of bolts and screws shall be such as to ensure suitable fastening and prevent buckling of the metals fastened.

L. Adequate ventilation is to be provided for custom fabricated equipment with built-in or drop-in integral refrigeration systems.

3.3 CLEAN-UP

A. At completion of the installation, clean up, lubricate, and adjust where necessary items of equipment provided and turn them over in first-class condition.

1. Where stainless steel surfaces are disturbed by the installation or fabricating process, such surface shall be finished to match adjoining undisturbed surfaces.

2. At the completion of the installation work, stainless steel shall be gone over with a portable polishing machine and buffed to perfect surfaces. Painted surfaces shall be carefully gone over and retouched as required.

3.4 START-UP AND TESTING AND COMMISSIONING

A. Startup Services: Engage factory-authorized service representatives to perform startup services and to demonstrate and train City's maintenance personnel as specified below.

1. Coordinate food service equipment startup with service-utility testing, balancing, and adjustments. Do not operate steam lines before they have been cleaned and sanitized.

2. Remove protective coverings and clean and sanitize equipment, both inside and out, and relamp equipment with integral lighting. Where applicable, comply with manufacturer's written cleaning instructions.

3. Test each equipment item for proper operation. Repair or replace equipment that is defective in operation, including units that operate below required capacity or that operate with excessive noise or vibration.

4. Test refrigeration equipment's ability to maintain specified operating temperature under heavy-use conditions. Repair or replace equipment that does not maintain specified operating temperature.

5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

6. Test motors and rotating equipment for proper rotation and lubricate moving parts according to manufacturer's written instructions.

7. Test water, drain, gas, steam, oil, refrigerant, and liquid-carrying components for leaks. Repair or replace leaking components.

8. Train City's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance for each food service equipment item.

9. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."

10. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

11. Schedule training with City, through Architect, with at least 7 days' advance notice.

3.5 SEISMIC RESTRAINTS

A. Install equipment in these contract documents according to the "SMACNA Guidelines for Seismic Restraint of Kitchen Equipment" in any State, province, or jurisdiction that has legislated this requirement as necessary for acceptance. This shall include:

1. Identifying these items on his submittal drawings, Plans, Elevations, and Sections.

2. Showing required SMACNA methods of restraint on his submittal drawings.

3. Referencing the appropriate detail(s).

4. Obtain regulatory approval for all seismic engineering details.

B. If no SMACNA detail exists for a particular situation, prepare, and obtain approval for a special attachment detail:

1. Detail must be prepared by an engineer licensed by the State having jurisdiction over the project and accompanied by the supporting calculations used in the design.

2. Verify that the restraint design is appropriate to the building's structural conditions and the surfaces to which the equipment will be secured.

PART 4 - ITEMIZED PRODUCT SPECIFICATIONS

All Kitchen equipment must be coordinated with the Owner and Design Team prior to fabrication. Owner shall have existing equipment that must be relocated from existing facility. General Contractor must provide relocation allowance for kitchen equipment relocation.

Item 2.023 Coffee Brewer, Single Use NIKEC

Not In Kitchen Equipment Contract
Shown on drawings for information only.
To be provided by coffee vendor.

Item 2.079 Ice and Water Station Advance-Tabco S002

Advance Tabco Model D-24-WSIBL2
Ice & Water Unit, drop-in, single service, 18” x 21” overall (ice bin 18” x 13.5” x 12”), 1" diameter drain, stainless steel sliding removable cover, drip pan drain 1" dia., water cold 1/2" I.P.S., cut out size 15-1/4" x 20-5/8", 50-lb ice capacity, NSF
Model K-54A Water Filler Faucet, deck mounted, single hole, 13-1/2"H (overall above countertop), 12"H glass clearance, lead free.

Acceptable alternate conforming to the above by: Eagle, Emjac, Boos

Item 2.609 Coffee Brewer

Not In Kitchen Equipment Contract
Shown on drawings for information only.
To be provided by coffee vendor.

Item 3.009 Point-of-Sale Unit

Not In Kitchen Equipment Contract
Shown on drawings for information only.
To be provided by contractor.

Item 3.017A Waste Container

Rubbermaid Commercial Products Model 1955959

Slim Jim® Container, 16-gallon, 22"L x 11"W x 25"H, with venting channels, molded-in handles, general purpose waste, open type without lid, high-impact plastic construction, black, Made in USA

Item 4.137 Oven: Impingement, Rapid-Cook, & Convection
TurboChef Plexor Multi-Oven
Three cooking compartments; one each impinger, rapid-cook, and convection
Controls on the front, oven drawers opening to the left
Stainless steel support stand with casters
Ventless
208/3, 39 amps, NEMA 15-50P plug with 6' cord

No alternates this item.

Item 4.155 Convection Oven, Electric
Vulcan Model VC5ED
Convection Oven, electric, single-deck, standard depth, solid state controls, 5-hour timer with digital display enhancement, 150° to 500°F temperature range, (5) oven racks per deck, independently operated removable doors with double pane windows, porcelain on steel interior, interior light, stainless steel front, top, & sides, 23-3/4" painted legs, 1/2 HP blower motor, 12.5kW, NSF, UL, ENERGY STAR®
Stainless steel leg stand with stainless steel shelf & adjustable rack supports on 8" stainless steel legs
Casters (set of four, 2 locking) for Single Deck Oven or for Leg Stand

Item 4.301 Microwave Oven
Panasonic Model NE-12521
PRO1 Commercial Microwave Oven, 1200 Watts, 0.6 cu. ft. capacity, compact, (15) power levels, 5-stage cooking, 30 program memory capacity, self-diagnostics, oven cycle counter, LCD digital display with countdown, see-thru left hinged door, programmable lock, stackable, LED interior light, 120v/60/1-ph, 17.3 amps, cord, NEMA 5-20P, cULus, NSF

Acceptable alternate conforming to the above by: Amana, Sharp

Item 4.761 Range
Vulcan model EV36S-6FP208
Restaurant Range, electric, 36", (6) 2.0 kW French hotplates, infinite controls, standard oversized oven, includes (1) rack, stainless steel front, sides, single-deck high shelf
Set of four casters (2 with brakes)

Acceptable alternate conforming to the above by: Garland, Southbend

Item 7.101 Ice Cream Cabinet
Silver King Model SKFDI18-ELUS1
Ice Cream Freezer, drop-in, (1) hinged folding lid, adjustable temperature control, manual defrost, stainless steel interior, stainless steel & galvanized exterior, bottom-mounted self-contained refrigeration, R290, 115v/60/1-ph, 2.1 amps, NEMA 5-15P, cETLus, ETL-Sanitation

Acceptable alternate conforming to the above by: Delfield, Randell

Item 8.001 Ice Maker
Hoshizaki Model KM-350MAJ
Ice Maker, Cube-Style, 22"W, air-cooled, self-contained condenser, production capacity up to 489 lb/24 hours at 70°/50° (393 lb AHRI certified at 90°/70°), crescent cube style, stainless steel finish, R-404A refrigerant, 115v/60/1-ph, 9.05 amps, NSF, UL, ENERGY STAR®

Acceptable alternate conforming to the above by: Ice-o-Matic, Manitowoc, Scotsman

Item 8.030 Water Filtration System for Ice Maker
Hoshizaki Model H9320-51
Water Filtration System, single configuration, 18.4" H (manifold & cartridge)

Acceptable alternate conforming to the above by: Ice-o-Matic, Manitowoc, Scotsman

Item 8.091 Ice Bin
Hoshizaki Model B-300SF
Ice Bin, 22"W, top-hinged front-opening door, 300-lb ice storage capacity, for top-mounted ice maker, stainless steel exterior, 6" painted flange legs included, protected with H-GUARD Plus Antimicrobial Agent, ETL, ETL-Sanitation

Item 9.001 Corner Guard
Eagle Group Model CG-O-48
Outside Corner Guard, 2" x 2" x 48", includes adhesive tape backing, stainless steel

Acceptable alternate conforming to the above by: Eagle, Emjac, Boos

Item 9.002 Wall Sheathing, Stainless Steel
Custom stainless steel wall sheathing, included with exhaust hood

Item 9.004A Pass Window Frame
Advance Tabco Model TA-84F-30
Pass-Thru Window Frame, 30" wide x 36” high
All welded, all stainless-steel channel frame vertically at both sides and across the top of the opening. Coordinate with pull-down closure by others. Verify wall thickness.

Acceptable alternate conforming to the above by: Eagle, Emjac, Boos

Item 9.004B Pass Window Frame
Advance Tabco Model TA-84F-60
Pass-Thru Window Frame, 60" wide x 36” high
All welded, all stainless-steel channel frame vertically at both sides and across the top of the opening. Coordiante with pull-down closure by others. Verify wall thickness.

Acceptable alternate conforming to the above by: Eagle, Emjac, Boos

Item 9.021A,B,C,D,E,F,G,H Worktable with Cabinet Base
Eagle Group Model CBHxxxxSE-BS series

Spec-Master® Series Worktable, cabinet base with hinged doors, length and depth per plan (24” or 30”) with 4-1/2"H backsplash, 14/304 stainless steel top, rolled front edge, hinged doors, Uni-Lok® gusset system, stainless steel cabinet body, legs, & adjustable bullet feet, NSF
Fixed bottom stainless-steel shelf, adjustable stainless-steel middle shelf.
Integral stainless-steel end splash, factory installed, welded, at walls and adjacent equipment.
Omit doors and provide a blank stainless-steel body panel where doors are not accessible.
All doors to be provided with locks, keyed alike.
Where shown on plan provide integral sink.

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 11.003 Popcorn Popper
Gold Medal Products Model 2085
60 Special Popcorn Machine, electric, countertop, 6 oz. kettle capacity, strip heater, heated corn deck, stainless steel kettle, tempered glass, red dome, 1220 watts, 120v/60/1-ph, NEMA 5-15P, cULus, NSF

Acceptable alternate conforming to the above by: Cretors, Nemco, Winco

Item 12.311 Refrigerator, 48”, Undercounter
True Mfg. - Model TUC-48-ADA-HC
Undercounter Refrigerator, 34" working height, 33 - 38°F, (2) stainless steel doors, (4) PVC coated adjustable wire shelves, stainless steel top & sides, clear coated aluminum interior with stainless steel floor, 3" castors, R290 Hydrocarbon refrigerant, 1/5 HP, 115v/60/1-ph, 3.0 amps, NEMA 5-15P, cULus, UL EPH Classified, CE, ADA Compliant, Made in USA
3" casters, standard
Bolt locks, factory installed (per door section - one lock)

Acceptable alternate conforming to the above by: Continental, Beverage-Air, Traulsen, Hoshizaki

Item 12.311WB Refrigerator, 48” Work-Top
True Mfg. - Model TWT-48-ADA-HC
Work Top Refrigerator, two-section, 34" working height, rear mounted self-contained refrigeration, stainless steel top with rear splash, (2) stainless steel doors, (4) PVC coated adjustable wire shelves, stainless steel front & sides, clear coated aluminum interior with stainless steel floor, 3" castors, R290 Hydrocarbon refrigerant, 1/5 HP, 115v/60/1-ph, 3.0 amps, NEMA 5-15P, cULus, UL EPH Classified, CE, ADA Compliant, Made in USA
3" casters, standard
Bolt locks, factory installed (per door section - one lock)

Acceptable alternate conforming to the above by: Continental, Beverage-Air, Traulsen, Hoshizaki

Item 12.319WB Freezer, 27”, Work Top
True Mfg. - General Foodservice Model TWT-27F-HC
Work Top Freezer, one-section, -10°F, rear mounted self-contained refrigeration, stainless steel top with rear splash, (1) stainless steel door, (2) PVC coated adjustable wire shelves, stainless steel front & sides, clear coated aluminum interior with stainless steel floor, 5" castors, R290

Hydrocarbon refrigerant, 1/4 HP, 115v/60/1-ph, 2.3 amps, NEMA 5-15P, cULus, UL EPH Classified, CE, Made in USA, ENERGY STAR®1 ea Self-contained refrigeration standard
5" Casters, standard
Bolt locks, factory installed (per door section - one lock)

Item 12.331 Refrigerator, Reach-In, Two-Section
True Mfg. - Model T-49-HC
Refrigerator, reach-in, two-section, (2) stainless steel doors, (6) PVC coated adjustable wire shelves, interior lighting, stainless steel front, aluminum sides, aluminum interior with stainless steel floor, 4" castors, R290 Hydrocarbon refrigerant, 1/2 HP, 115v/60/1-ph, 5.4 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA, ENERGY STAR®
Self-contained refrigeration standard
Doors hinged per plan
4" stem castors, standard

Acceptable alternate conforming to the above by: Continental, Beverage-Air, Traulsen, Hoshizaki

Item 12.334 Freezer, Reach-In, Two-Section
True Mfg. - Model T-49F-HC
Freezer, reach-in, two-section, -10°F, (2) stainless steel doors, (6) PVC coated adjustable wire shelves, interior lighting, stainless steel front, aluminum sides, aluminum interior with stainless steel floor, 4" castors, R290 Hydrocarbon refrigerant, 1 HP, 115v/60/1-ph, 9.6 amps, NEMA 5-15P, Made in USA, cULus, UL EPH Classified, ENERGY STAR®
Self-contained refrigeration standard
Doors hinged per plan
4" stem castors, standard

Acceptable alternate conforming to the above by: Continental, Beverage-Air, Traulsen, Hoshizaki

Item 12.345D Refrigerator, Salad/Sandwich Prep, 48”
True Mfg. - Model TSSU-48-12-HC
Sandwich/Salad Unit, (12) 1/6 size (4"D) poly pans, stainless steel insulated cover, 11-3/4"D cutting board, (2) full doors, (4) PVC coated adjustable wire shelves, stainless steel top, front, sides, GalFan coated steel back, aluminum interior with stainless steel floor, 5" castors, R290 Hydrocarbon refrigerant, 1/3 HP, 115v/60/1-ph, 5.8 amps, NEMA 5-15P, cULus, UL EPH Classified Made in USA
Full complement of 4” deep poly pans.
Model 871794 Basic Over shelf, 46-1/16"W x 9"D x 14-3/8"H, for TSSU/TUC/TWT-48, stainless steel
Bolt locks, factory installed (per door section - one lock)
5" Casters, standard

Acceptable alternate conforming to the above by: Continental, Beverage-Air, Traulsen, Hoshizaki

Item 12.370 Beverage Display Refrigerator, Glass Doors
True Mfg. - Model GDM-47-HC-LD

Refrigerated Merchandiser, two-section, (8) shelves, (2) Low-E thermal glass sliding doors, LED interior lights, powder coated steel exterior, white aluminum interior with stainless steel floor, R290 Hydrocarbon refrigerant, 1/2 HP, 115v/60/1-ph, 8.5 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA
Exterior: Stainless steel
Interior: Black aluminum with black shelving
Barrel lock factory installed, slide two door model

Acceptable alternate conforming to the above by: Continental, Beverage-Air, Traulsen, Hoshizaki

Item 13.143 Shelving Unit, 24" x 36", Mobile

Eagle model QPMU2436E-G5-74
Mobile Starter Unit, 5-tier, 36"W x 24"D x 74"H, (1) wire shelf frame with louvered QuadPLUS® green shelf mat, (3) Quad-Adjust® wire shelf frames with louvered QuadPLUS® green shelf mats, (1) wire shelf frame with solid QuadPLUS® green shelf mat, EAGLEgard® hybrid epoxy finish with MICROGUARD® antimicrobial protection, 5" swivel stem casters (2 with brake)

Acceptable alternates conforming to the above by: Metro, SPG, Advance-Tabco, Centaur

Item 14.008 Three-Compartment Sink
Eagle Group Model 312-12-3-12-SL
Sink, three compartment, 66"W x 27"D, (3) 12"W x 20"L x 12"D sink bowls, 12" drainboards on left & right, 9-1/2"H backsplash with 1" upturn & tile edge, rolled edges on front & sides, 8" OC splash mount faucet holes, includes (3) basket drains, 304 stainless steel construction
Model 300489 Faucet, 10" long
(3) Model 341189 Twist Handle Drain, 1-1/2 or 2" NPS connection
(3) Model -TB Twist bracket, per drain
Stainless steel legs with front-to-back stainless steel crossbracing
(4) Model 300692 Bullet Feet, stainless steel, each

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 14.022 Wall Shelves, 12" x 60"
Eagle Group Model WS1260-16/3
Shelf, wall-mounted, 60"W x 12"D, rolled front edge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 14.302 Hand Sink
Eagle Group Model E20
Integral hand sink welded in place, one compartment, 10" wide x 14" front-to-back x 9-1/2" deep bowl, 4" OC deck mount faucet with gooseneck spout (302004), includes basket drain, 18/304 stainless steel construction, NSF

Faucet hole punched on 4" centers, standard
Standard faucet
Left and right integral splash shields
Soap and towel dispensers

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 14.321 Two-Bowl Sink
Eagle Group Model E21
Integral two-compartment sink welded in place, two compartments, each 14" wide x 16" front-to-back x 9-1/2" deep bowls, includes (2) basket drains, 20/304 stainless steel construction, NSF
Faucet hole punched on 4" centers, standard
Model 313306 T&S Faucet, deck mount, 4" OC, 8" swing spout, low lead

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 14.619 Wall Cabinet, 24”
Eagle Group Model WCH-24
Cabinet, wall mount, 24"W x 15"D x 28"H, enclosed front, sloped top, (1) removable double-panel hinged door, fixed intermediate shelf with safety edges, back recessed with concealed mounting plate, 18/304 stainless steel construction, NSF
Door locks, all keyed alike

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 14.621 Wall Cabinet, 48”
Eagle Group Model WCH-48
Cabinet, wall mount, 48"W x 15"D x 28"H, enclosed front, sloped top, (2) removable double-panel hinged doors, fixed intermediate shelf with safety edges, back recessed with concealed mounting plate, 18/304 stainless steel construction, NSF
Door locks, all keyed alike

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 14.622 Wall Cabinet, 60”
Eagle Group Model WCH-60
Cabinet, wall mount, 60"W x 15"D x 28"H, enclosed front, sloped top, (2) removable double-panel hinged doors, fixed intermediate shelf with safety edges, back recessed with concealed mounting plate, 18/304 stainless steel construction, NSF
Door locks, all keyed alike

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 14.623 Wall Cabinet, 72”
Eagle Group Model WCH-72
Cabinet, wall mount, 72"W x 15"D x 28"H, enclosed front, sloped top, (3) removable double-panel hinged doors, fixed intermediate shelf with safety edges, back recessed with concealed mounting plate, 18/304 stainless steel construction, NSF
Door locks, all keyed alike

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 15.022S Worktable, 30” x 48”, with Sink
Eagle Group Model T3048SE-BS
Spec-Master® Series Worktable, 48"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (4) stainless steel legs & adjustable bullet feet, NSF
Model E10 Square edge table, front and/or rear, per table
Model 500772 Drawer, 20" x 20", with pull flange, stainless steel
Model E23 Sink, 16" x 20" x 14" bowl, for 30"W tables, complete with faucet & basket drain
Model E36 All welded construction, legs, undershelf & top

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 15.223 Worktable, 30” x 60”, Stationary
Eagle Group Model T3060STE-BS
Spec-Master® Series Worktable, 60"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, Uni-Lok® gusset system, (4) stainless steel legs & adjustable bullet feet, NSF
Model E10 Square edge table, front and/or rear, per table
Model 500772 Drawer, 20" x 20", with pull flange, stainless steel
Model E36 All welded construction, legs, cross rails, & top

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 15.342 Table, Work, 48” x 48”, Stationary
Eagle Group Model T4848SE
Spec-Master® Series Worktable, 48"W x 48"D, 14/300 series stainless steel top, rolled edge on front & back, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (4) stainless steel legs & adjustable bullet feet, NSF
Two (2) model 502946 Drawer Assembly, 20" x 20" x 5", 430 type stainless steel housing & frame,
removable drawer pan, NSF approved removable slides, hemmed safety pull handle, locks keyed alike

Acceptable alternate conforming to the above by: Advance-Tabco, Emjac, Boos

Item 17.219 Dishwasher, Undercounter
Hobart Model CUH-1
Centerline Dishwasher, undercounter, 22 11/16"W x 24"D x 32 5/16"H, high temperature sanitizing, (24) racks/hr, freshwater rinse, .84 gal/rack, delime notification and cycle, service diagnostics with error notifications, soft start, detergent & rinse aid pumps, 208-240v/60/1-ph, 24.2-27.5 amps, ships with (1) peg rack and (1) combo rack, cULus, NSF
Model PWRCORD-30A240V1P Power Cord Kit, 208-240v/60/1-ph, NEMA 6-30P plug included (net)
Model DWT-CUH Drain water tempering kit for Centerline CUH (net)
Model DISHRAK-PEG20 Peg rack
Model DISHRAK-COM20 Combination rack

Model CHEMSENSORS-CU Chemical sensing indicators for detergent & rinse aid (low chemical alert – 2 included in kit)
Model ARMSET-CUSST Stainless steel wash/rinse arm assembly – includes (2), 1 set for top and 1 set for bottom

Acceptable alternate conforming to the above by: Champion, Meiko, Stero, Insinger

Item 18.084 Pretzel Cabinet, Humidified
Hatco Model FSDT-1
Flav-R-Savor® holding & display cabinet, (1) door, (4) tier circle rack with motor, LED lighting, with 6 ft cord & plug, 1440 watts, CE, cULus, UL EPH Classified, Made in USA
120v/60/1-ph, 1414 watts, 11.8 amps, NEMA 5-15P (domestic voltage), standard
Clear Anodized Aluminum housing, finish, standard
Model FSDT3TPT (3) tier Pretzel Tree

Item 21.101 Exhaust Hood
Captive-Aire Model 5424ND2

8’-6" Long x 54” wide Exhaust-Only Wall Canopy Hood with Built-in 3" Back Standoff

- 304 SS Where Exposed

- Fire Cabinet on end per plan, 12.00" Width x 54" Length

- Filters: 16" tall x 16" (15.625" by 15.625") wide Stainless Steel Captrate Solo filter with hook, ETL Listed. Particulate capture efficiency: 85% efficient at 9 microns, 76% efficient at 5 microns

- Recessed Round LED fixtures and LED Lights, 3500 K warm output.

- 1/2 Pint Grease Cup, Flanged Slotted

- Field wrapper:18.00" High Front, Left, right

- Electrical Package Installation in Utility Cabinet at factory

- Backsplash: 80.00" High X 9’-6" Long 304 SS Vertical (Includes End Caps & Divider Bars)

- Parts required to mount riser sensor on riser with 3-inch insulation double wall duct.

- Left and right vertical end panels: 27" Top Width, 21" Bottom Width, 80" High Insulated 304 SS

Acceptable alternates conforming to the above by: Accurex, Avtec, Gaylord, Halton, Streivor

Item 21.909 Fire Extinguishing System
Ansul model R102
Furnish and install a complete, fully operational wet chemical automatic fire extinguishing system to provide surface, duct and plenum protection in conformance with NFPA-96 and local code requirements. All exposed components shall be chrome plated. Field installation of system shall be done by a trained and authorized distributor. No exposed piping is acceptable with the exception of appliance drops (if applicable). Appliance drops shall be chrome-plated or stainless steel. Furnish mechanical gas shut-off valves (verify size) and provide to Plumber on site for installation.

Provide a Y Strainer that is approved for the mechanical removal of solids from pressurized gas lines which can be installed in a horizontal or vertical position. The Y Strainer to be manufactured of Carbon Steel and include a removable type 304 stainless steel Strainer with .016-inch perforations (#40 mesh). The Y Strainer to include a removable cap that allows the Strainer to be removed for inspection and/or cleaning when the gas line is not pressurized. Coordinate with Division 22 (Plumbing) for the Y Strainer size and ANSI flanged or threaded pipe connection specifications. Division 22 to install the Y Strainer in accordance with the installation instructions.

System shall be complete in all respects, including remote manual activation device, mechanical gas solenoid valve, and provision for connection to a remote notification device.

Verify location with food service drawings.

Acceptable alternates conforming to the above by: Kidde, Pyro-Chem

END OF SECTION

SECTION 116500 – SPORTS NETS

1 GENERAL

1.1 SECTION INCLUDES

A. Sport nets and recreational equipment including the following:
   1. Baseball netting.

1.2 RELATED SECTIONS

A. Section 323170 – Chain link Fencing

1.3 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. 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. Shop Drawings

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.5 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.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Carron Net Co., Inc. , which is located at: P. O. Box 177 1623 - 17th St.; Two Rivers, WI 54241 ; Toll Free Tel: 800-558-7768 ; Tel: 920-793-2217; Fax: 920-793-2122 ; Email:request info (sales@carronnet.com); Web:www.carronnet.com

B. Substitutions: Approved Equal

2.2 APPLICATIONS/SCOPE

A. Baseball Netting: Nylon, 1-3/4 inches (44 mm) mesh used for baseball barrier. Refer to drawings for size and shape.

1. Installation Hardware:
    a. Cable: Cable assembly for suspending and drawing the nets as required per the manufacturer's recommendations. Including turnbuckles, galvanized steel cable, cable clamps, and thimbles. Attachment hardware to be determined by application.
    b. Hardware as detailed on drawings.
2. Constructed of:
    a. Carron Stock #77705 - #36 nylon, 1-3/4 inches (44 mm) mesh, knotted netting, color: Black (weather treated for outdoors). Cord tensile strength: 340 lbs.
3. Color for Netting:
    a. Black.
4. Edge Binding for Netting:
    a. Per the Manufacturer's recommendations.

3 EXECUTION

3.1 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.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in conformance with manufacturer's recommendations. Provide installation that is complete and to the standards required by League rules.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 116501 - BASKETBALL GOAL

A. Model No. 2000+ Breakaway Goal as manufactured by Performance Sports Systems, Noblesville, IN.

B. Goal shall be fabricated from 5/8'' diameter cold drawn alloy steel round formed to an 18'' inside diameter ring. Inside of ring shall be positioned 6'' from face of backboard by heavy, formed steel hinged-type housing with removable cover to conceal mounting bolts and shock absorption mechanism of goal and to protect against finger entrapment.

C. Goal shall be designed to absorb shock loads from slam dunking or hanging on rim. Shock absorption feature shall be provided by means of a special offset hinge arrangement rim and back plate mounting housing with concealed molded rubber shock absorber.

D. Goal shall meet NCAA, FIBA and NFSHSA specification on moveable rims, which states, "A moveable basket ring shall have rebound characteristics identical to those of a non-moveable ring." Goal shall be factory set to proper flex and rebound requirements.

E. Goal shall be finished in durable, electrostatic powder coated official orange finish.

F. Goal shall be furnished complete with heavy-duty white anti-whip nylon netting and mounting hardware.

G. Allowed substitution: Approved equal.

END OF SECTION

SECTION 116502 - CEILING SUSPENDED FORWARD FOLD BACKSTOPS

A. Model No. 3107 "Single Post" ceiling suspended, forward fold, front braced backstop as manufactured by Performance Sports Systems, Noblesville, Indiana.

B. "Single Post" vertical main mast assembly shall be constructed of 6-5/8'' O.D. (.120" wall ASTM A-500 Grade B) structural steel tubing with diagonal side sway braces of 2 ½"X 1 ½" X14 gauge ASTM A-513 rectangular steel tube sway braces miter cut and welded in place to a top horizontal 4" x 1 ½" x 0.18" web ASTM A-36 steel channel. Sway braces shall attach to mast above backboard for maximum rigidity. Mast and sway braces shall be welded for ceiling heights up to thirty (30) feet. Mast and sway braces shall be clamped for ceiling heights over thirty (30) feet (Model 3106). Backstop shall be front braced and fold forward. The front brace assembly shall have a fully adjustable folding knee joint allowing for exact playing position and maintenance free operation.

   Goal shall be mounted directly through backboard into a heavy structural steel weldment which shall be clamped to vertical 6-5/8'' O.D. center mast. (This direct attachment feature transfers the load on the goal directly to the mast pipe minimizing stress to glass backboard). The goal and backboard mounting design shall conform to NCAA, NFSHSA and FIBA regulations.

C. The all-welded "Single Post" design shall be suspended from custom adjustable hangers with bronze bushings designed to be offset no less than 4" behind the center line of gravity of mast, providing for proper weighting of the assembly and insuring that unit locks securely and automatically into playing position.

D. Backstop shall be supported from 3-1/2'' O.D. pipe anchored to roof framing members by means of heavy formed steel support fittings. Superstructure pipes are to be reinforced with special bridging or bracing when truss centers exceed spans of fourteen (14) feet. Each attachment clamp must be capable of supporting static loads of at least 10,000 lbs. with no deflection.

E. All metal parts shall have factory applied powder coat finish in standard BLUE. Final color to be selected by City & Architect.

F. Allowed substitution: Approved equal.

END OF SECTION

SECTION 116503 - RECTANGULAR GLASS BACKBOARDS

A. Model No. LXP4200 Steel Framed Rectangular Glass Backboard by Performance Sports Systems, Noblesville, IN.

B. Backboards shall be 42 inches high by 72 inches wide.

C. Backboard shall be manufactured from 1/2" tempered glass set in heavy extruded aluminum or steel framing and cushioned by shock absorbing vinyl. Official borders and target area permanently fired into glass.

D. Goal mounting structure shall be a heavy welded formed steel assembly, and directly attached to lower horizontal frame member to minimize stress on glass.

E. The backboard shall have a limited lifetime warranty against defects in material and workmanship, and when used with Performance Sports System's Direct Goal Attachment feature shall be protected against shatter and breakage of glass. The board must meet NCAA, FIBA and NFSHSA specifications.

F. Allowed substitution: Approved equal.

END OF SECTION

SECTION 116505 - GYMNASIUM DIVIDER CURTAIN

Model No. 4050 Center Drive Curtain by Performance Sports Systems Inc., Noblesville, IN.

A. Gym Divider Curtain shall be center rolling type compactly storing not to exceed 13.5” below structural attachment support without the use of hoist cables and belts.

B. Lower one-half of curtain shall be solid vinyl coated polyester (avg. 19 or 22 oz. per square yard as required). Flammability is rated as self-extinguishing by California State Fire Code. All seams to be welded with full 1" contact welds. A padded pocket shall be formed along the bottom edge of curtain to accommodate a 1-5/8" diameter batten pipe for curtain support. Available in thirteen (13) standard colors (color to be determined by Architect). The upper half of curtain shall be vinyl coated polyester mesh (avg. 9 oz. per square yard). Flammability is rated as self-extinguishing by California State Fire Code. Available in six (6) standard colors (color to be determined by Architect). Color samples provided upon request.

C. Top and bottom of curtain shall be fabricated with a pocket to conceal continuous, 1.9 O.D. tubes extending the full length of the fabric to ensure proper support. Top tube shall be supported from the overhead support structure with a threaded rod-type support fitting to provide proper horizontal alignment with the floor The total length of the bottom tube to be padded with a 2-1/8” diameter closed cell polyethylene protective padding material.

D. Curtain shall be operated by two (2) synchronized internal tubular motors (120 volt, 60 hertz, single phase). Each motor shall have a maximum torque of 700-inch pounds with a speed of 14 rpm, and shall be equipped with integral up and down limit switches with two locking push buttons. Motors shall be maintenance free, permanently lubricated and have overheating protection features. Motors shall feature electromagnetic disk brakes that allow smooth and accurate stops without slippage and full braking power in event of power failure. Each motor shall feature a three-stage planetary gear mechanism for quiet and reliable use. Curtain does not require cables, belts, strap, or torque arms for operation and all electrical components shall be neatly contained in overhead uperstructure. Curtains with cables, belts, straps, or torque arms shall not be considered equal. Curtains with electrical components not contained in overhead superstructureshall not be considered equal.

E. Drive tube shall be affixed in the center of the curtain and supported by the vinyl mesh by means of an integrated slot in the tube and a nylon cord sewn into the bottom of the mesh panel. The vinyl panel shall be attached to the drive tube my means of an integrated slot in the tube and a nylon cord sewn into the top of the vinyl panel.

F. Motors shall utilize a flush mounted single keyed switch to raise and lower the divider curtain (eliminating the need for two keys). Key switch shall be located

so that curtain is in full view of authorized operator at all times. Optional wireless remote control or keypad control operation available.

G. Motors shall have a five (5) year warranty against material defects and workmanship. Curtain motors with less than a five (5) year warranty shall not be considered equal. Vinyl shall have one (1) year warranty against material defects and workmanship.

H. Allowed substitution: Approved equal.

END OF SECTION

SECTION 116505.1 - PROTECTIVE WALL PADDING

A. Model No. 4110 by Performance Sports Systems, Noblesville, IN.

B. Panels are 2’ wide by 6’ high, with custom sizes available. Panels shall be constructed of 2’’ thick 3.5 lb. density polyurethane. Each panel shall be covered with 14 oz. polyester reinforced laminated vinyl and cemented to 7/16’’ OSB exterior grade wood panels with one-inch nailing margins at top and bottom (for securing panels to wall). Available in fifteen (15) standard colors (color to be determined by Architect). All cutouts in panels shall be made in field to fit job conditions.

C. Vinyl flammability rated as self-extinguishing by the California State Fire Code.

Provide following options:
1. Custom Heights and Widths
2. 1 ½” Foam
3. ½” Fire Rated Plywood Backer

D. Allowed substitution: Approved equal.

END OF SECTION

SECTION 116507 - VOLLEYBALL FLOOR SLEEVES AND COVERS

VOLLEYBALL FLOOR SLEEVES AND COVERS

A. Model 6430 Cover plate shall be 6-1/4" diameter by 9/16" thick brass alloy with attached hinged cover. The diameter of the opening shall be five (5) inches. Hinge and four holes in ring (for screwing into floor) shall be completely concealed under cover when in closed position, allowing for a completely flat surface. When installed in "floating" wood floors, floor plate is connected to floor only, allowing it to move with expansion and contraction of floor.

B. Model 6400 Sleeve shall be 3.5" I.D. steel measuring 9" long. Steel sleeves eliminate the possibility of electrolysis between concrete and sleeve that occurs with aluminum sleeves. Sleeves made of aluminum shall not be considered as equal. Cover plates the sleeve are furnished as separate units to allow for any "floating" of playing surface.

VOLLEYBALL STANDARDS

A. Model No. 6100 Scholastic System including standards, net, antenna, protective upright pads, as manufactured by Gared Sports, Noblesville, IN. Provide Model No. 6104 center standards as required for adjacent court layouts. Refer to drawings for configuration of court layouts.

B. Standards are 3.5" O.D. high strength, lightweight extruded anodized aluminum. The upper telescoping adjustable tube shall be 2 7/8" lightweight high strength aluminum. Finish shall be gray anodize. Uprights shall be removable type designed for use within ground sleeves or above floor tee-bases. The upright shall be provided with adjustable high impact rubber foot to protect finished floors and allow for additional precise net adjustment. The uprights will have spring loaded infinite net height adjustment between 6' to 8'-4" to meet all age group height settings for both men and women. Standards shall meet NCAA, NFSHSA and USVBA specifications. The net tensioner shall incorporate a heavy duty, self-locking ratchet mechanism with a compression clutch brake release. A high tensile nylon strap will be used with the winch to achieve required net tension.

STANDARD PROTECTIVE PADS

A. Model No. 6010 volleyball standard protective pads by Gared Sports, Noblesville, IN. Provide model No. 6020 for center standards as required.

B. Pads shall be 72'' high and fabricated from 1-1/4" thick polyurethane foam covered with 14 oz. vinyl coated nylon on the outside and jersey inner liner. Each pad shall be tailored to easily fold around upright and fastened by Velcro flaps, covering winch and net tensioning hardware. The front side of pad shall be furnished with an opening for attaching and tensioning bottom strap from net. Available in sixteen (16) standard colors (color to be determined by Architect). Standard pads to meet NCAA, NFSHSA and USVBA specifications.

VOLLEYBALL NET

A. Model No. 7602 Collegiate volleyball net by Gared Sports, Noblesville, IN.

B. Net shall be 32’ L x 39” H with #48 black nylon mesh measuring approximately 4” by 4” square. The net shall have a 2” white double thickness binding on all 4 sides. The end sleeves shall feature a 1' diameter wood dowel completely enclosed in vinyl. The net must meet NCAA, NFSHSA and USVBA specifications.

NET ANTENNA

A. Model No. 6412 antenna by Gared Sports, Noblesville, IN.

B. Antennae is secured firmly to the net by insertion in the full-length pockets in the sidelines markers fully eliminating the possibility of the antennae dislodging from the net.

SUBSTITUTION

A. Allowed substitution: Approved equal.

END OF SECTION

SECTION 116623 GROUP CONTROLLER & KEYPAD

Model No. TSC1500 Group Controller
as manufactured by Performance Sports Systems, Noblesville, IN.

A. Wall mounted touchpad control system shall be designed as an alternate to conventional key switch type controls, to operate backstops, divider curtains, electric height adjusters, overhead volleyball systems, batting cages, and power control for auxiliary gymnasium electrical equipment such as lighting, scoreboards, etc. The control system can operate a maximum amount of 160 devices and a maximum of 50 auxiliary devices. Anything else less is not considered equal. Keypad requires constant pressure on the pad to control gym equipment. Control of auxiliary equipment only requires a single press of the pad.

B. The TSC1500 shall provide a time saving control feature for multiple operations of basketball backstops, height adjusters and curtains including auxiliary devices. These devices may be operated individually or in a group up to 8 devices at a time. It provides two different kinds of groups. There will be one group type for auxiliary devices and one for standard moving devices. A moving device can be placed into a group up to the size of 8. There are a total of 75 possible moving groups the system can control and a total 24 auxiliary groups it can control. This allows having up to 8 backstops in a group or 8 curtains in a group for example or turning on 8 sets of lights. Any other system capable of less is not considered equal.

C. The security log in will be a four-digit password. This password can be changed at any time. It can also be manually reset to factory default from the relay board. If no button has been pressed within the time window of thirty seconds, the system will lock and log itself off. The TSC1500 can use a maximum of up to 8 keypads within a system. Key pad shall be flush mounted into a standard square electrical box (4" X 4" X 2 ½") with a 12volt circuit to relay panels.

D. The TSC1500 will include a single relay box capable of operating 10 devices. It will also can run 8 devices at once if enough power has been run to the location. The system is expandable up to 16 relay boxes until 160 devices are reached. Relay circuits are capable of up to 250v and 30-amp load. There are 20 relays per relay box. Size of each relay box is 18" wide X 24" tall X 6" deep.

E. The TSC1500 will feature a tri color LED and a buzzer to provide feedback to the user during operation. The system shall also include an LED at the relay board to show activation of relay. Key pad is fuse protected at the master relay board for circuit protection. Control systems not utilizing an LED and buzzer will not be accepted as equal.

F. Wiring of all electrical components shall be in accordance with local codes, and in accordance with manufacturer's instructions. All conduit, wiring, junction boxes, and components not specified shall be furnished and installed by electrical contractor. In addition, relay panel dip switch settings and relay set programming per the facilities requirements shall be the responsibility of the electrical contractor.

G. One relay box can individually or simultaneously control 8 devices, regardless of type of device, if the correct amount of power is wired to equipment.

END OF SECTION

SECTION 116643 - INTERIOR ELECTRONIC SCOREBOARD

PART 1 – GENERAL

Provide a total of four (4) scoreboards in the gymnasium. Provided and installed by Contractor. Model 2750 MPCW wireless. Manufacturer NENCO.

1.1 SUMMARY

A. Section includes Interior, electronic, multi-sport multi-purpose basketball/volleyball/wrestling scoreboards including control center, and other accessories for complete functional installation.
   1. Division 11
   2. Division 26
   3. Division 27 & 28
   4. Section 10 14 00 Signage

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:
   1. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
B. National Electrical Code.
C. Federal Communications Commission, Part 15 Rules & Regulations.
D. UL and C-UL Standard for Electric Signs

1.3 SUBMITTALS

A. Provide in accordance with Section 01 33 00 - Submittal Procedures:

   1. To minimize the environmental impact of multiple paper copies, product installation prints, instructions and diagrams of manufacturer will be submitted in a paperless fashion. The end user shall receive all pertinent hard-copy documentation at delivery.
   2. Product data for scoreboards, controls, and accessories shall include descriptions of control functions etc.
   3. Installation drawings, face layout, dimensions, construction, electrical wiring diagrams, and method of anchorage. (Paperless when applicable).
   4. Copy of guarantee required by Paragraph 1.5 for review by Architect.
   5. Manufacturer's installation instructions.
   6. Finish Samples.

1.4 QUALITY ASSURANCE

A. Source limitation: All components including scoreboard, control center, control cable, and other accessories and installation hardware shall be products of a single manufacturer.
B. Manufacturer qualifications: Company specializing in manufacturing electronic scoreboards with 10 years minimum successful worldwide experience.

C. Scoreboards and other electrical components shall be certified for use in United States and Canada by Underwriter Laboratories, (UL), Inc. and shall bear either UL or C-UL label only.
D. Scoreboards and other electrical components shall be electrically grounded in accordance with National Electrical Code (NEC), Article 600.

1.5 GUARANTEE

A. Provide under provisions of Section 01 78 00 - Closeout Submittals: Guarantee to cover defects in materials and workmanship.
   1. Scoreboards, scoring tables, marquees, message centers, video boards* and Stadium Pro loudspeaker enclosures are guaranteed for a period of five (5) years from the date of invoice against defects in workmanship or materials. **Video Board exclusions include 8815, 8825, 8835, 8845.

   2. Wireless components, portable scoreboards and solar power kit carry a two (2) year guarantee from date of invoice. Hand-held controls and switches carry a one (1) year guarantee from date of invoice. The Stadium Pro loudspeaker front printed scrim is guaranteed for one (1) year from the date of invoice. Video Board Models 8815, 8825, 8835, and 8845 are guaranteed for one (1) year from date of invoice, unless additional years of warranty is purchased. For products supplied by third-party suppliers (i.e. cameras, computers, computer monitors, radar guns, loudspeakers, amplifiers and associated electronics), Purchaser agrees to accept the manufacturer's warranty, if any, in lieu of any warranty by Nevco.

   3. Lifetime telephone support.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nevco Inc, 301 East Harris Avenue, Greenville, Illinois 62246; 800-851-4040; www.nevco.com.
B. Requests to use equivalent products of other manufacturers shall be submitted in accordance with Product Substitution Procedures.

2.2 MATERIALS

A. Aluminum face and perimeter frame: Fabricated from 0.050 inch minimum thickness, ASTM B221 aluminum sheet.
B. Finish: Acrylic polyurethane paint. Color as selected by Architect from manufacturer's standard range. Color selection by City from standard color pallet no custom colors.
C. Electronics: Low voltage, solid state, 2-wire cable, multiplex system, quartz crystal controlled.
D. Provide fiber optic communication interface to reduce the threat of damage from electrical storms.

E. LED (light emitting diode) units: Seven-bar, segmented digits in protective aluminum cover, rated typical life 100,000 hours, and designed to provide excellent visibility from all angles and sides.
F. Provide location specific universal power cord with plug for world-wide installation.
G. Control cable where required shall be UL listed, 2-wire, type RG-58/U, coaxial cable, 1/4 inch diameter.
H. Junction boxes where required: Sheet metal box and cover, 4-1/2 x 2-1/8 x 2-1/8 inches min. complying with NEMA standards.

2.3 SCOREBOARDS

A. Type: Interior, multi-purpose basketball/volleyball/wrestling electronic scoreboard with two integral horns, changeable captions, LED displays for time, scores, period, number of players fouling with personal fouls, team fouls, bonus and double bonus indicators, and next possession arrows; Model 2750-NL (base) as manufactured by Nevco Inc. Rear-lit (RL) caption plates or Electronic Team Names (ETN) are optional, and the scoreboard shall be capable of in-the-field retrofit. Only LED lighting shall be used for rear-lit captions, incandescent lighting excluded. No captions shall be applied directly to the face of the scoreboard. All caption plates will be changeable and made of polyvinylchloride with vinyl lettering applied.
   1. Size: 8 feet long x 6 feet high x 8 inches deep.
   2. Approximate hanging weight: 130 pounds.
   3. Captions:
      a. 6 inches high:
         1) Basic: "Home", "Guests", and "period".
         2) Basketball: "fouls" and "player".
         3) Volleyball: "won" and "game".
         4) Wrestling: "match" and "weight".
   4. LED displays:
      b. Timing: Super Bright Red or White 13 inches high digits with lit colon.
      c. Team scores: Super Bright Amber or White 13 inches high digits.
      d. Period: Super Bright Amber or White 9 inches high digits.
      e. Player number with personal fouls, game, and weight: Super Bright Red or White 9 inches high digits.
      f. Team fouls, games won, and match: Super Bright Amber or White 9 inches high digits.
      g. Next possession: Super Bright Amber or White arrow for each team.
      h. Include bonus and double bonus in the form of a 4 inch Super Bright Red or White LED “B”.
   5. Rear-lit captions (when specified) shall require zero maintenance.
   6. Provide Advertising /Team logo area 3 each, 12” x 12” minimum.
   7. Suspension mounting attachments will be included.
   8. Power requirement: All options included: 158 Watts, MAX, 100-240 Volts AC w/Power Factor Correction.

2.4 ACCESSORIES/OPTIONS

A. Provide each scoreboard or accessory with control cable of length required. Electrical junction boxes, conduits, mounting hardware, and other accessories as required for installation are to be provided by others.
B. Electronic Team Names: "HOME" and "GUEST" caption plates to be replaced with programmable Electronic Team Names as manufactured by Nevco Inc.
   1. Specify changeable team names. (ETN) Shall not require controller upgrade, use of additional accessories or computer.
   2. Specify (R)ed or (A)mber ETN LED's. Final color selection by City.
C. Provide rear-lit caption plate option. Specify (RL).
D. Provide for optional Team Name in place of "HOME".
E. Additional accessories noted below:
   1. Nevco Inc Shot Clocks / End of Period (EOP) system.
   2. Nevco Inc Stats Panels
   3. Protective Nets/Screens.
   4. Nevco Inc "A", "AD", or "ADL" signs including Artwork with unlimited amount of color.
   5. Nevco Inc Locker Room Clocks.
   6. Nevco Inc Full Color, Red or Amber Message Centers.

2.5 CONTROL CENTER

A. Type: Wired, microprocessor based operator's control center designed to operate different models of scoreboard by interchange of keyboard overlay; Model MPC as manufactured by Nevco Inc. Console will operate earlier scoreboards from Nevco Inc.
   1. Console: High impact, break-resistant gray plastic 11 x 9-1/2 x 4-1/8 inches.
   2. Features:
      a. Provide with LED displays, lithium cell battery backup to maintain scoreboard memory and time of day, self test mode, power on-off switch, alternate time control, and multiple scoreboard operation.
      b. Split and raised 40 key keyboard, internal beeper acknowledging each entry, and bookmark capabilities.
      c. Keyboard overlays for scoreboard or accessory.
      d. Remote hand-held main time switch with integral horn button.
      e. 25 feet control cable with connectors.
      f. Timer features: Time of day display, multiple time out timers with warning, interval horn, up-count auto stop with horn, and $1/10^{th}$ second display during last minute.
      g. Dimmer control for scoreboard.
   3. Power requirements: 120 volts, 12 watts, 50/60 Hz.
   4. Provide option of battery supply for control operation if utility power not available.
   5. Provide carrying case for control center, cable, and hand-held switch; Model CC-3 as manufactured by Nevco Inc.
      a. Size: 18-1/2 x 14-1/2 x 6 inches.
      b. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.

B. Type: Wireless, microprocessor based, operator's control center with receiver unit mounted at scoreboard and designed to operate different models of scoreboard by interchange of keyboard overlay; Model MPCW as manufactured by Nevco Inc. Console will operate earlier scoreboards from Nevco Inc.
   1. Unit shall comply with Part 15 of FCC Rules regarding interference.
   2. Console: High impact, break-resistant gray plastic 11 x 9-1/2 x 4-1/8 inches.
   3. Features:
      a. Control can be used to operate both wireless and wired scoreboards.
      b. Power on-off switch.
      c. Split and raised 40 key keyboards, internal beeper acknowledging each entry, and bookmark capabilities.
      d. Keyboard overlays for scoreboard or accessory.
      e. Remote hand-held main time switch with integral horn button.
      f. Provide with LED displays, lithium cell battery backup to maintain scoreboard memory and time of day, self test mode, power on-off switch, alternate time control, and multiple scoreboard operation.
      g. Timer features: Time of day display, multiple time out timers with warning, interval horn, upcount auto stop with horn, and $1/10^{th}$ second display during last minute.
      h. Dimmer control for scoreboard.
   4. Receiver: Sturdy impact resistant construction, 6 x 4 x 1.5 inches with 4 inch antenna and mounted at scoreboard.
   5. Maximum range: 1,000 feet from control center to receiver.
   6. Power adapters: Provide for each control center.
      a. Input: 120 volts, 0.4 amps, 50/60 Hz.
      b. Output: 9 volts, 1.67 amps, 15 watts.
   7. Provide option of battery supply for control operation if utility power not available.
   8. Provide carrying case for control center and hand-held switch; Model CC-3 as manufactured by Nevco Inc.
      a. Size: 18-1/2 x 14-1/2 x 6 inches.
      b. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.

C. Type: Handheld wireless, basic, AA battery operated, sport specific, control center with receiver unit mounted at scoreboard; Model $MPCX_2$ as manufactured by Nevco Inc. Control will have operability with earlier scoreboards from Nevco Inc.
   1. Unit shall comply with Part 15 of FCC Rules and Regulations.
   2. Control unit: High impact, break-resistant black ABS plastic Size: 3-1/4" x 5-1/2" x 7/8"
   3. Features:
      a. Wireless operation within 1000 feet.
      b. Operate multiple scoreboards simultaneously.
      c. System allows multiple controllers to link to individual scoreboards.
      d. High visibility LCD display with a sealed keyboard.
      e. Long battery life with indicator; include two AA batteries.
      f. Single hand operation with a no slip grip.
      g. Built-in belt clip.
      h. Wireless signal strength meter and internal antenna.

4. Receiver: Injection molded case, 5-1/2 by 3-3/4 by 2 inches mounted at scoreboard.
5. Maximum range: 1,000 feet from control center to receiver.
6. Power adapters: Provide for each scoreboard receiver.
    a. Input: 120 volts, 0.4 amps, 50/60 Hz.
    b. Output: 9 volts, 1.67 amps, 15 watts.
7. Provide carrying case for up to two control centers, Model CC-4 as manufactured by Nevco Inc.
    a. Size: 18-1/2 x 14-1/2 x 6 inches.
    b. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.

D. Type: ONE Mobile Controller App wireless, basic, all sports, control center with receiver unit mounted at scoreboard; Controller App will have operability with earlier scoreboards from Nevco.
8. Unit shall comply with Part 15 of FCC Rules and Regulations.
9. Control unit: Customer-provided mobile device (Apple iOS or Android, phone or tablet)
10. Features:
    c. Secure Wifi wireless operation within 750 feet, line of sight.
    d. Operate multiple scoreboards simultaneously.
    e. System allows multiple controllers to link to individual scoreboards.
11. Receiver: Injection molded case,10 by 6 by 2.5 inches mounted at scoreboard in accordance with instructions.
12. Maximum range: 750 feet] from control center to receiver, line of sight.
13. Power adapters: Provide for each scoreboard receiver.
    a. Input: 100-240 volts, 1.5 amps, 50/60 Hz.
    b. Output: 50 volts, 1.2 amps, 60 watts.
8. Provide suitable, RF transparent, NEMA 4 enclosure for receiver, to be located upon scoreboard supporting structure per installation diagrams.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify exact scoreboard and control center quantities and junction box locations with Architect.
B. Coordinate requirements for electrical power, wall blocking, auxiliary framing and supports, suspension cables, and other components to be provided under other Specification Sections to ensure adequate provisions are made for complete, functional installation of scoreboards. [Ensure that building roof structure has been designed for loads of suspended scoreboards.]
C. Coordinate scoreboard electrical requirements to ensure proper power source, conduit, wiring, and boxes are provided. Prior to installation, verify type and location of power supply.

3.2 INSTALLATION

A. Install scoreboards and accessories in accordance with manufacturer's instructions and approved installation drawings.
B. Before installation, field test scoreboards and accessories for operating functions. Ensure that scoreboards accurately perform all operations. Correct deficiencies.
C. Rigidly mount scoreboards and accessories level and plumb with brackets and fasteners.
D. Clean exposed surfaces.
E. Protect scoreboards and finishes from other construction operations.

3.3 DEMONSTRATING AND TRAINING

A. In accordance with Section 01 75 00 – Starting and Testing of Systems, provide demonstration and training session for City's representative covering operation and maintenance of electronic scoreboard.

4. SUBSTITUTION

A. Allowed substitution: Approved equal or better.
B. Final color selection by City.

END OF SECTION

SECTION 116643.1 - SCOREBOARD ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Interior, electronic, multi-sport multi-purpose basketball/volleyball/wrestling scoreboard including control center, and other accessories for complete functional installation.
   1. Section 11 66 23 Group Controller & Keypad

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:
   1. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
B. National Electrical Code.
C. Federal Communications Commission, Part 15 Rules & Regulations.
D. UL and C-UL Standard for Electric Signs

1.3 SUBMITTALS

A. Provide in accordance with Section 01 33 00 - Submittal Procedures:

   1. To minimize the environmental impact of multiple paper copies, product installation prints, instructions and diagrams of manufacturer will be submitted in a paperless fashion. The end user shall receive all pertinent hard-copy documentation at delivery.
   2. Product data for scoreboards, controls, and accessories shall include descriptions of control functions etc.
   3. Installation drawings, face layout, dimensions, construction, electrical wiring diagrams, and method of anchorage. (Paperless when applicable).
   4. Copy of guarantee required by Paragraph 1.5 for review by Architect. (Paperless when applicable).
   5. Manufacturer's installation instructions. (Paperless when applicable).
   6. Finish Samples.

1.4 QUALITY ASSURANCE

A. Source limitation: All components including scoreboard, control center, control cable, and other accessories and installation hardware shall be products of a single manufacturer.
B. Manufacturer qualifications: Company specializing in manufacturing electronic scoreboards with 10 years minimum successful world-wide experience.
C. Scoreboards and other electrical components shall be certified for use in United States and Canada by Underwriter Laboratories, (UL), Inc. and shall bear either UL or C-UL label only.

D. Scoreboards and other electrical components shall be electrically grounded in accordance with National Electrical Code (NEC), Article 600.

1.5 GUARANTEE

A. Provide under provisions of Section 01 78 00 - Closeout Submittals: Guarantee to cover defects in materials and workmanship.
   1. 5 years parts and factory labor guarantee for scoreboards, marquees, message centers, video displays,Stadium Pro loudspeaker enclosures and accessories from invoice date.
   2. 2 years part and factory labor guarantee for wireless components, portable scoreboards and solar power kits from invoice date
   3. 1 year part and factory labor guarantee for scorer's tables, handheld controls and switches from invoice date.
   4.. Lifetime telephone support.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nevco, Inc., 301 East Harris Avenue, Greenville, Illinois 62246; 800-851-4040; www.nevco.com.
B. Requests to use equivalent products of other manufacturers shall be submitted in accordance with Product Substitution Procedures.

2.2 MATERIALS

A. Aluminum face and perimeter frame: Fabricated from 0.050inch minimum thickness, ASTM B221 aluminum sheet.
B. Finish: Acrylic polyurethane paint. [Color No. 120 - Teal Blue]. Final color to be chosen by City & Architect.
C. Electronics: Low voltage, solid state, 2-wire cable, multiplex system.
D. Provide galvanically isolated communication interface to reduce threat of damage from electrical storms.
E. LED (light emitting diode) units: Seven-bar, segmented digits in protective aluminum cover, rated typical life 100,000 hours, and designed to provide excellent visibility from all angles and sides.
F. Provide location specific universal power cord with plug for world-wide installation.
G. Control cable where required shall be UL listed, 2-wire, type RG-58/U, coaxial cable,1/4 inch diameter.
H. Junction boxes where required: Sheet metal box and cover, 4-1/2 x 2-1/8 x 2-1/8 inches min. complying with NEMA standards.

2.3 SCOREBOARDS

2.4 ACCESSORIES/OPTIONS

A. Provide each scoreboard or accessory with control cable of length required. Electrical junction boxes, conduits, mounting hardware, and other accessories as required for installation are to be provided by others.

B. Electronic Team Names: "HOME" and "GUEST" caption plates to be replaced with programmable Electronic Team Names as manufactured by Nevco, Inc..
   1. Specify changeable team names as ETN. Shall not require controller upgrade, use of additional accessories, or computer.
   2. Specify (R)ed, (A)mber or (W)hite ETN LED's . To be selected by the City.

C. Provide rear-lit caption plate option. Specify [RL].

D. Provide for optional Team Name in place of "HOME" if NL/RL is selected.

E. Locker room clock: Provide LED clocks for locker rooms indicated on Drawings to be interfaced with control center for basketball scoreboard. Model 9715 as manufactured by Nevco, Inc..
   1. Size (length by height by depth): 14.25 x 10.25 x 1.5 inches.
   2. Construction: Fabricate with brushed aluminum frame and Acrylic face with imprinted diffusion.
   3. Electrical power: 100-240 Volts AC 18 Watts; powered from the Indoor Accessory Driver (IAD).
   4. Locker room clock shall display same time and timing functions as scoreboard timer.
   5. LED display: Red 4.5 inches high digits.

F. Protective screens: Equip each scoreboard face with protective screen.
   1. Type: Fabric net screen installed as protection in front of scoreboard; Model 2750 MPC Wireless Protective Screen as manufactured by Nevco, Inc..
   2. Size: Completely cover scoreboard face and allow for installation of top and bottom battens.
   3. Net: Black fabric mesh in 1.75" x 1.75 inches grid.
   4. Finish battens and wire mesh with non-glare, flat, powder coated paint.

G. End of Period Lights: Pair of perimeter light strip sets installed on rear side of glass basketball backboards to signal end of period; universal fit for 42" or 48" backboard. Model EOP1 as manufactured Nevco, Inc..
   1. Light strips: Self adhesive light strips with Super Bright Red LED displays and end wire connectors to join light strips.
   2. Powered from the Indoor Accessory Driver (IAD).
   3. Power requirement per module, (stand alone): 120 volts, 1.5 amps, requires earth ground.
   4. Can program to light up horn and/or shot time violation.

H. Portable Possession Indicator: Portable, battery operated LED next possession indicator;
   Model PI-1 as manufactured by Nevco, Inc..
   1. Size (length by height by depth): 16-1/4 x 4-1/2 x 5-1/2 inches.

2. Weight: 5 pounds.
3. Power: Requires 6 C batteries.
4. Construction: Aluminum with black finish with white "poss" and two arrows. Provide selector switch on top.
5. LED displays: Four red LED clusters of five each LEDs in front and on back show possession for each team.

I. Scorer's Table Possession Indicator: LED next possession indicator that mounts to Scorer's Table with brackets (included). Requires 120v adapter (included). Model PI-1 (Padded) as manufactured by Nevco, Inc..
1. Size (length by height by depth): 16-1/4 x 4-1/4 x 5-1/2 inches.
2. Weight: 5 pounds.
3. Power: Requires 120v power adapter (included).
4. Construction: Aluminum with black finish with white "poss" and two arrows. Provide selector switch on back of unit.
5. LED displays: Four red LED clusters of five each LEDs in front and on back show possession for each team.

J. Shot clocks: Pair of electronic units displaying main time, shot clock time, with external horn box that can be mounted above or below the clock; Model SSC-T5 as manufactured by Nevco, Inc..
1. Size: 24 inches x 24 inches x 2 inches deep.
2. Approximate weight each: 50 lbs.
3. LED displays:
   a. Main time: High Intensity Red or White 5 inches high digits.
   b. Shot clock time: High Intensity Amber or White 13 inches high digits.
4. Horn: Sounds automatically at 0 shot clock time.
5. Power requirement: 12vDC low voltage power input from included 120 VAC 1.2A Power Supply; powered from the Indoor Accessory Driver (IAD).
6. Construction: Shot Clock face made of durable Lexan, encased in an aluminum cabinet.

K. Shot clocks: Pair of electronic units displaying main time, shot clock time with external horn box that can be mounted above or below the clock; Model SSC-T9 as manufactured by Nevco, Inc..
1. Size: 36 inches x 30 inches x 2 inches deep.
2. Approximate weight each: 58 lbs.
3. LED displays:
   a. Main time: High Intensity Red or White 9 inches high digits.
   b. Shot clock time: High Intensity Amber or White 13 inches high digits.
   c. End of period goal lights: High Intensity Red LED's.
4. Horn: Sounds automatically at 0 shot clock time.
5. Power requirement: 12vDC low voltage power input from included 120 VAC 1.2A Power Supply; powered from the Indoor Accessory Driver (IAD).
6. Construction: Shot Clock face made of durable Lexan, encased in an aluminum cabinet.

L. Shot clocks: Pair of portable electronic units displaying shot clock time with external horn box that can be mounted above or below the clock; Model SSC-7 as manufactured by Nevco, Inc..
   1. Size: 20 inches x 20 inches x 2 inches deep.
   2. Approximate weight each: 40 lbs.
   3. LED displays:
      a. Shot clock time: High Intensity Red or White 13 inches high digits.
   4. Horn: Sounds automatically at 0 shot clock time.
   5. Power requirement: 12vDC low voltage power input from included 120 VAC 1.2A Power Supply; powered from the Indoor Accessory Driver (IAD).
   6. Construction: Shot Clock face made of durable Lexan, encased in an aluminum cabinet.

M. Player name and foul panel set: Provide set of slide letter player name panels and electronic player foul panels accommodating 12 players and to be mounted on both sides of [existing] scoreboard; Model F712-P12 as manufactured by Nevco, Inc..
   2. Overall size for each name/foul combination panel (width by height by depth): 58-3/4 x 80-1/2 x 8 inches.
   3. Approximate hanging weight per side: 84 pounds.
   4. Player name panels: Two double-faced panels with slide rows each side to receive 12 player numbers and names; Model P12 as manufactured by Nevco, Inc..
      a. Equip with holder brackets and rope pulley assembly to lower panel for reversing and changing names.
      b. Furnish with set of 456 letters and 156 numbers, 4-3/4 inches high.
   5. Player foul panels: Two panels of 12 rows each with 6 LED clusters per row; Model F712 as manufactured by Nevco, Inc..
      a. Red or White LED cluster indicates player foul, red LED cluster indicates player has fouled out, and orange LED cluster indicates player is in game.
      b. Panels installed at sides of scoreboard adjacent to player name panels.
      c. Non-illuminated or illuminated caption: 6 inches "fouls". [NL][RL]
      d. Power requirement: 100-240 volts AC, 30 watts max., requires earth ground.

N. Player name and foul panel set: Provide set of slide letter player name panels and electronic player foul panels accommodating 15 players and to be mounted on both sides of scoreboard; Model F715-P15 as manufactured by Nevco, Inc..
   1. Overall size for each name/foul combination panel (width by height by depth): 58-3/4 x 97-1/2 x 8 inches.
   2. Approximate hanging weight per side: 105 pounds.
   3. Player name panels: Two double-faced panels with slide rows each side to receive 15 player numbers and names; Model P15 as manufactured by Nevco, Inc..
      a. Equip with holder brackets and rope pulley assembly to lower panel for reversing and changing names.
      b. Furnish with set of 456 letters and 156 numbers,4-3/4 inches high.
   4. Player foul panels: Two panels of 15 rows each with 6 LED clusters per row; Model F515 as manufactured by Nevco, Inc..

a. Red or White LED cluster indicates player foul, red LED cluster indicates player has fouled out, and orange LED cluster indicates player is in game.
b. Panels installed at sides of scoreboard adjacent to player name panels.
c. Non-illuminated or illuminated caption: 6 inches "fouls". [NL][RL]
d. Power requirement: 100-240 volts AC, 34 watts max., requires earth ground.

O. Statistics panels: Pair of electronic, multi-purpose basketball/volleyball panels displaying five basketball or six volleyball player numbers, two statistics per player; Model SD7-5 as manufactured by Nevco, Inc..
1. Panel size (length by height by depth): 36 x 71-1/4 x 8 inches.
2. Approximate panel hanging weight: 86 pounds.
3. Non-illuminated, changeable captions: 5-3/8 inches high letters.
a. Basketball: "plyr", "pts", and "fls".
b. Volleyball: "plyr", ["digs",] ["kills",] ["aces",].
c. LED displays:
1) Player number and second statistic: Super Bright Red or White 5 inches high digits.
2) First statistic: Super Bright Amber or White 5 inches high digits.
4. (Option) Electronic Message Centers [ETN] option to replace caption plates for “points”, “fouls”, “kills”, “digs”, “aces” etc.
5. Power requirement: 100-240 volts AC, 94 watts max., requires earth ground..
6. Provide set with Model MPC microprocessor control unit, two junction boxes, length of control cable, and mounting hardware as required for complete functional installation.

P. Statistics panels: Pair of electronic, multi-purpose basketball/volleyball panels displaying five basketball or six volleyball player numbers, two statistics per player, and either time outs left or total substitutions; Model SD7-9 as manufactured by Nevco, Inc..
1. Panel size (length by height by depth): 60 x 95-1/4 x 8 inches.
2. Approximate panel hanging weight: 154 pounds.
3. Non-illuminated, changeable captions: 5-3/8 inches high letters.
a. Basketball: "player", "points", "fouls", and "t.o.l." for time outs left.
b. Volleyball: "player", ["digs",] ["kills",] ["aces",] and "sub" for total substitutions.
c. LED displays:
1) Player number and second statistic: Super Bright Red or White 9 inches high digits.
2) First statistic: Super Bright Amber or White 9 inches high digits.
4. Horns: One per panel to be sounded together manually by control operator.
5. (Option) Electronic Captions [EC] option to replace caption plates for “points”, “fouls”, “kills”, “digs”, “aces” etc.
6. Power requirement: 100-240 volts AC, 157 watts max, requires earth ground..
7. Provide set with Model MPC microprocessor control unit, two junction boxes, length of control cable, and mounting hardware as required for complete functional installation.

Q. Statistics panels: Pair of electronic, basketball panels displaying five player numbers, number of points and fouls per player, and time outs left per team; Model PTF-7 as manufactured by Nevco, Inc..
   1. Panel size (length by height by depth): 60 x 80-1/2 x 8 inches.
   2. Approximate panel hanging weight: 100 pounds
   3. Back lighted captions: 6 inches high "player", "points", "fouls", and "t.o.l." for time outs left.
   4. LED displays:
      a. Player number, fouls, and time outs left: Super Bright Red or White 9 inches high digits.
      b. Points: Super Bright Amber or White 9 inches high digits.
   5. Horns: One per panel to be sounded together manually by control operator.
   6. (Option) Electronic Message Centers [ETN] option to replace caption plates for “points”, “fouls” etc.
   7. Power requirement per panel: 100-240 volts AC, 121 watts max., requires earth ground..
   8. Provide set with Model MPC microprocessor control unit, two junction boxes, length of control cable, and mounting hardware as required for complete functional installation.

2.5 CONTROL CENTER

A. Type: Wired, microprocessor based operator's control center designed to operate different models of scoreboard by interchange of keyboard overlay; Model MPC as manufactured by Nevco, Inc.. Console will operate earlier scoreboards from Nevco, Inc..
   1. Console: High impact, break-resistant gray plastic 11 x 9-1/2 x 4-1/8 inches.
   2. Features:
      a. Provide with LED displays, lithium cell battery backup to maintain scoreboard memory and time of day, self test mode, power on-off switch, alternate time control, and multiple scoreboard operation.
      b. Split and raised 40 key keyboard, internal beeper acknowledging each entry, and bookmark capabilities.
      c. Keyboard overlays for scoreboard or accessory.
      d. Remote hand-held main time switch with integral horn button.
      e. 25 feet control cable with connectors.
      f. Timer features: Time of day display, multiple time out timers with warning, interval horn, up-count auto stop with horn, and 1/10th second display during last minute.
      g. Dimmer control for scoreboard.
   3. Power requirements: 120 volts, 12 watts, 50/60 Hz.
   4. Provide option of battery supply for control operation if utility power not available.
   5. Provide carrying case for control center, cable, and hand-held switch; Model CC-3 as manufactured by Nevco, Inc..
      a. Size: 18-1/2 x 14-1/2 x 6 inches.
      b. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.

B. Type: Wireless, microprocessor based, operator's control center with receiver unit mounted at scoreboard and designed to operate different models of scoreboard by interchange of keyboard overlay; Model MPCW as manufactured by Nevco, Inc.. Console will operate earlier scoreboards from Nevco, Inc.
   1. Unit shall comply with Part 15 of FCC Rules regarding interference.
   2. Console: High impact, break-resistant gray plastic 11 x 9-1/2 x 4-1/8 inches.
   3. Features:
      a. Control can be used to operate both wireless and wired scoreboards.
      b. Power on-off switch.
      c. Split and raised 40 key keyboards, internal beeper acknowledging each entry, and bookmark capabilities.
      d. Keyboard overlays for scoreboard or accessory.
      e. Remote hand-held main time switch with integral horn button.
      f. Provide with LED displays, lithium cell battery backup to maintain scoreboard memory and time of day, self test mode, power on-off switch, alternate time control, and multiple scoreboard operation.
      g. Timer features: Time of day display, multiple time out timers with warning, interval horn, upcount auto stop with horn, and $1/10^{th}$ second display during last minute.
      h. Dimmer control for scoreboard.
   4. Receiver: Sturdy impact resistant construction, 6 x 4 x 1.5 inches with 4 inch antenna and mounted at scoreboard.
   5. Maximum range: 1,000 feet from control center to receiver.
   6. Power adapters: Provide for each control center.
      a. Input: 120 volts, 0.4 amps, 50/60 Hz.
      b. Output: 9 volts, 1.67 amps, 15 watts.
   7. Provide option of battery supply for control operation if utility power not available.
   8. Provide carrying case for control center and hand-held switch; Model CC-3 as manufactured by Nevco, Inc..
      a. Size: 18-1/2 x 14-1/2 x 6 inches.
      b. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.

C. Type: Handheld wireless, basic, AA battery operated, sport specific, control center with receiver unit mounted at scoreboard; Model $MPCX_2$ as manufactured by Nevco, Inc.. Control will have operability with earlier scoreboards from Nevco, Inc.
   1. Unit shall comply with Part 15 of FCC Rules and Regulations.
   2. Control unit: High impact, break-resistant black ABS plastic Size: 3-1/4” x 5-1/2” x 7/8”
   3. Features:
      a. Wireless operation within 1000 feet.
      b. Operate multiple scoreboards simultaneously.
      c. System allows multiple controllers to link to individual scoreboards.
      d. High visibility LCD display with a sealed keyboard.
      e. Long battery life with indicator; include two AA batteries.
      f. Single hand operation with a no slip grip.
      g. Built-in belt clip.
      h. Wireless signal strength meter and internal antenna.

4. Receiver: Injection molded case, 5-1/2 by 3-3/4 by 2 inches mounted at scoreboard.
5. Maximum range: 1,000 feet from control center to receiver.
6. Power adapters: Provide for each scoreboard receiver.
    a. Input: 120 volts, 0.4 amps, 50/60 Hz.
    b. Output: 9 volts, 1.67 amps, 15 watts.
7. Provide carrying case for up to two control centers, Model CC-4 as manufactured by Nevco, Inc..
    a. Size: 18-1/2 x 14-1/2 x 6 inches.
    b. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify exact scoreboard and control center quantities and junction box locations with Architect.
B. Coordinate requirements for electrical power, wall blocking, auxiliary framing and supports, suspension cables, and other components to be provided under other Specification Sections to ensure adequate provisions are made for complete, functional installation of scoreboards. [Ensure that building roof structure has been designed for loads of suspended scoreboards.]
C. Coordinate scoreboard electrical requirements to ensure proper power source, conduit, wiring, and boxes are provided. Prior to installation, verify type and location of power supply.

3.2 INSTALLATION

A. Install scoreboards and accessories in accordance with manufacturer's instructions and approved installation drawings.
B. Before installation, field test scoreboards and accessories for operating functions. Ensure that scoreboards accurately perform all operations. Correct deficiencies.
C. Rigidly mount scoreboards and accessories level and plumb with brackets and fasteners.
D. Clean exposed surfaces.
E. Protect scoreboards and finishes from other construction operations.

3.3 DEMONSTRATING AND TRAINING

A. In accordance with Section 01 75 00 – Starting and Testing of Systems, provide demonstration and training session for City's representative covering operation and maintenance of electronic scoreboard.

4. SUBSTITUTION

A. Allowed substitution: Approved equal.

END OF SECTION

SECTION 116800.1 – INTERIOR PLAYGROUND EQUIPMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. The interior playground
B. Indoor Playgrounds International's playgrounds are designed and manufactured in compliance with the ASTM of U.S.A., EN of Europe, CSA of Canada and AS of Australia. The ASTM
C. All the playgrounds designed and manufactures meet the latest A.D.A standards for indoor playgrounds standards, we can minimize the injury hazards in the indoor playground and to make sure that it will pass safety inspections in any country, mandatory or voluntary.

1.1 WARRANTY

A. Indoor Playgrounds International LLC Warrants its products to be free from structural failure due to defects in materials or workmanship during normal use and installation. Warrantly commences on the date the playground is received and installation has been completed. The warranty stated is valid ONLY if the products and structures and/or equipment is:
    a. Unloaded from the shipping container(s) in accordance with Indoor Playgrounds International's instructions;
B. Erected properly and in conformity by Indoor Playgrounds International's professional installation crews;
C. Maintained and inspected in accordance with Indoor Playgrounds International LLC instructions (failure by the owner to maintain the product according to the maintenance requirements may void this warranty);
D. Subjected to normal use for the purpose for which the goods were designed; not subject to vandalism, misuse, neglect, accident or unauthorized addition or substitution of parts;
E. Not moved, in whole or in part, after its initial installation; and not modified, altered, or repaired by persons other than approved by INDOOR PLAYGROUNDS INTERNATIONAL or its designees in any respect which, in the sole judgment of INDOOR PLAYGROUNDS INTERNATIONAL, affects the condition or operation of the structures.
F. Indoor play structure
    a. 8 MONTHS on parts made of galvanized steel and cast aluminum, all stainless-steel hardware such as: screws, bolts, nuts, washers
    b. 18 MONTHS on components made of plastic or fiberglass material, such as: slide, themed panel, cube, straight & curved flange, tunnel, swing seats, junction box, tube.
    c. 18 MONTHS on soft wrapping material for play structure and soft play products, including: platforms, soft wall cushions, flooring mat, climbers, stairs, ball pit, punching bag and post padding.
    d. 18 MONTHS on: trampoline, webbing equipment, safety netting, and other play activities made of fiber glass material.
    e. 3 MONTHS on: air bed of spider climb tower, water bed for water trampoline, bar stools, and soft sofa in toddler area.
G. SPARE PARTS: All turn-key playgrounds of Indoor Playgrounds International will have certain amounts of spare parts shipped together with the playground to the customers. The spare parts are shipped to the customers as free service parts and should be sufficient to keep the playground maintained for 1 to 3 years.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Acceptable Manufacturer: Indoor Playgrounds Int'l.
13200 W Foxfore Dr. Suite 144
Surprise, AZ 85378
info@indoorplaygroundsintl.com
1(866)856-9778
B. Basis of design product: Indoor Playgrounds Int'l. Model Number: 2023100R3.
C. Substitutions: the Architect will consider products of comparable manufacturers as a substitution, pending the Contractor's submission of adequate documentation of the substitution in accordance with procedures in Division 1 of the project Manual.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 – Product Requirements

1.2 Materials

A. Steel pipes are hot-dip galvanized steel pipes. Whole pipe immersed in molten zinc.
B. Clamps are galvanized steel, welded and powder coated
C. Footing are cast iron bolted to the concrete floor
D. PVC Vinyl – Heavy-duty 18 oz. industrial grade PVC vinyl 0.55 mm thick, strengthened by 1000D nylon weaving inside the coating
E. Zip ties of high quality plastic
F. Deckboards High quality plywood, thick high density foam and wrapped in PVC vinyl
G. Brackets and screws for the deckboards to be powder coated
H. Anti-climb fire retardant netting
I. All major plastic components made of shatter proof compounded resins
J. Polycarbonate windows
K. Fiberglass with coloured gel for wave slides

PART 3 – Execution

1.1 NSTALLATION

A. Install products in strict compliance with manufacturer's written instruction and recommendations.

END OF SECTION

SECTION 116800 – PLAY FIELD EQUIPMENT AND STUCTURES

PART 1 – GENERAL

1.1 SUMMARY

A. All the materials used in the manufacturing of Playsystems. Playstructures have a proven track record of durability and are widely used in the playground industry. All play components have been certified and validated to be in conformance with the ASTM F1487 Standard unless otherwise noted. Play components displaying the CSA and TUV logos are certified to those standards. To the best of our knowledge, they also conform to the U.S. Consumer Products Safety Commission (CPSC) Guidelines.

B. Unless otherwise noted, all playstructures are considered accessible according to the 2010 ADA Standard for Accessible Design.

C. Main Play Area – This play area consists of three Landscape Structures play structures and a Skyways 2 sail shade structure, with synthetic grass safety surfacing.

D. 5-12 Play Structure – This structure, geared toward 5 to 12-year-old children, is a custom design with a large square tower and a number of complementary play components. The components of this structure include:
   1. Swiggleknots Bridge
   2. Chimney Climber 64"
   3. Dtr PlayBooster Steelx Rh Handloop
   4. Dtr PlayBooster Steelx Grab Bar
   5. (5) 12" X 12" X 8-16" High Rpl Board Stepper DB - Mink & Cedar Board
   6. Dtr PlayBooster 206"steel Post
      123" Oc Belt Tunnel W/taller End Panels Above Deck - Includes: (2) Steelx End Panels
   7. 42" X 42" Oc 96" Net/belt Climb Tower DB - Includes Belt Landing; Belting & 1-slide Sit Down Deck; 2 Angled-rpl Barriers (cedar & Mink)
   8. Crest Climber 24' Belt To 96' Belt Above Deck - Enclosed With Perf Belting Material
   9. 84" X 84" Square Tower W/geonetrix Style Nets & Belts DB - 84" X 84" Oc. Includes 8 Roof Posts; Grips, 7 Vibe Perf Barriers, 8 Angled Rpl Barriers (cedar & Mink), Rpl Climbing Wall W/ Mobius Grips, Perforated Roof, Geonetrix Style Rope and Belt Climber Th
   10. Bubble Panel Above Deck
   11. Wire Barrier Above Deck
   12. Wire Barrier Tri-deck
   13. Marble Panel Above Deck
   14. (3) Handloop Assembly
   15. Handhold Leg Lift
   16. Overhead Ring Pull
   17. Lolliladder W/2 E-pods
   18. Slidewinder2 96"Deck
   19. Whooshwinder Slide

E. 5-12 Play Structure – This structure, geared toward 5 to 12-year-old children, is a custom design with a large square tower and a number of complementary play components. The components of this structure include:
   1. Motion W/play Table
   2. Weevos 3 Arch Mainstructure
      a. Boppity Bridge
      b. Swiggly Stix Bridge
      c. Wee Planet Climber Elongation
      d. Cozy Coaster Slide - W/astm Handrail, W/stairs Under Large Arch
   3. Saddle Spinner

F. Shade Structure – This Skyways shade structure will cover the majority of the 2-5 play components in the main play area. The large shade will consist of the following:
   1. Skyways Joined Triangle Sails - 4 Columns + 2 HDPE Tops
   2. 10' - 16'
   3. Approx. 1268 Sq. Ft
   4. Rapid Release Included

G. Afterschool Area – This play area consists of a Landscape Structures Playbooster structure designed to provide varied play experiences for children between the ages of 5 and 12 years old, and synthetic grass safety surfacing. Structure components will include:
   1. 5-12 Play Structure
      a. Clatterbridge 84 W/barriers
      b. Vertical Ascent 72"Deck
      c. Deck Link W/barriers - Steel End Panels 1 Step
      d. Deck Link W/barriers - Steel End Panels 2 Steps
      e. Lollipop Climber - 72"Deck
      f. Portal Climber W/permalene Handhold (left) - Equal Decks 72"
      g. Arcade Climber 96" Deck
      h. Tidal Wave Climber 48"Deck
      i. Mobius Climber W/permalene Handholds 72" Deck
      j. (2) Square Tenderdeck
      k. (4) Triangular Tenderdeck
      l. Kick Plate 8"rise
      m. Curved Transfer Module - Left 40"Deck
      n. Hexagon Tenderdeck
      o. Bubble Panel Above Deck
      p. Storefront Panel
      q. (2) Wire Barrier Above Deck
      r. Rock-n-ring Panel Ground Level
      s. Fun Mirror Panel Ground Level
      t. Optigear Panel Above Deck
      u. Marble Panel Above Deck
      v. Handhold Leg Lift
      w. E-pod Seat
      x. Slidewinder2 48"Deck DB - 1 Straight 1 Left
      y. Double Swoosh Slide - 96"Deck
      z. Firepole Perm Handholds - 72"Deck
      aa. Whooshwinder Slide - 72"Deck
      bb. Wire Crawl Tunnel Above Dec

H. Fitness Area – This area consists of Landscape Structures Healthbeat fitness equipment and synthetic grass surfacing. The following apparatus are included:
   1. Ab Crunch/leg Lift
   2. Assisted Row/Push-up
   3. Parallel Bars
   4. Balance Step
   5. Cardio Stepper
   6. Chest/Back Press
   7. Elliptical
   8. Pull-up/Dip
   9. Squat Press
   10. Stretch Material

1.2 MATERIALS

A. All materials shall be structurally sound and suitable for safe play. Durability shall be ensured on all steel parts by the use of time-tested coatings such as zinc plating, galvanizing, ProShield finish, TenderTuff coating, etc. Colors shall be specified.

1.3 FASTENERS

A. Primary fasteners shall be socketed and pinned tamperproof in design, stainless-steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications). All primary fasteners shall include a locking patch type material that will meet the minimum torque requirements of IFI-125. Manufacturer to provide special tools for pinned tamperproof fasteners.

1.4 TENDER TUFF COATING

A. Metal components to be TenderTuff-coated shall be thoroughly cleaned in a hot phospatising wash system, then primed with a water-based thermosetting solution. Primed parts shall be preheated prior to dipping in UV stabilized, liquid polyvinyl chloride (PVC), then salt cured at approximately 400 degrees. The finished coating shall be approximately .080" thick at an 85 durometer with a minimum tensile strength of 1700 psi and a minimum tear strength of 250 lbs/inch. Standard colors are available, all with a matte finish.

1.5 PRO SHIELD FINISH

A. All metal components with ProShield finish shall be thoroughly cleaned and pretreated through a multi-stage wash system. Parts are then thoroughly dried, preheated and processed through a set of powder spray guns where a minimum .002" of epoxy primer is applied. A minimum .004" of architectural-grade Super Durable polyester TGIC powder is applied. The average ProShield film thickness is .006".

B. ProShield is formulated and tested per the following ASTM standards. Each color must meet or exceed the ratings listed below:
   1. Hardness (D3363) rating 2H
   2. Flexibility (D522) pass 1/8" mandrel
   3. Impact (D2794) rating minimum 80 inch-pounds
   4. Salt Fog Resistance (B117 and D1654) 4,000 hours and rating 6 or greater
   5. UV Exposure (G154, 340 bulb) 3,000 hours, rating delta E of 2, and 90 percent gloss retention*
   6. Adhesion (D3359, Method B) rating 5B

C. The Paint Line shall employ a “checkered” adhesion test daily. Standard colors are available.

* Certain colors may exceed delta E of 2. Contact Landscape Structures for exceptions.

1.6 STEEL

A. Hot Dipped Galvanized (HDG) Steel. Steel components to be Hot Dipped Galvanized shall be thoroughly cleaned of organic compounds and dirt through complete immersion in a hot alkali solution. Cleaned parts shall undergo acid pickling to remove rust or scale. All parts shall then be fluxed to eliminate surface oxides and promote intermetallic development. Prepped parts shall then be submerged in a bath of molten zinc until the part reaches 840° F and the zinc reacts to form zinc/iron intermetallic layers on all surfaces inside and out. Hot Dipped Galvanized Parts shall be manufactured and inspected according to ASTM A123.

1.7 DECKS

A. All decks shall be of modular design and have 5/16" diameter holes on the standing surface. There shall be a minimum of (4) slots in each face to accommodate face mounting of components. Decks shall be manufactured from a single piece of low carbon 12 GA (.105") sheet steel conforming to ASTM specification A-1011. The sheet shall be perforated with a return flange on the perimeter to provide the reinforcement necessary to ensure structural integrity. There shall be no unsupported area larger than 3.5 square feet. The unit shall then be TenderTuff-coated brown or gray only. Decks shall be designed so that all sides are flush with the outside edge of the supporting posts. Not applicable for Evos or Weevos.

1.8 CONCRETE PRODUCTS

A. Two processes are used to produce concrete products. (See specific product installation/specification documents.)
   1. Glass Fiber Reinforced Concrete (GFRC) Products: Glass fiber is alkali-resistant (AR) with high tensile properties formulated for concrete. GFRC nominal product thickness is 1" with a unit weight of about

12 lbs per square foot and an average ultimate flexural strength of 2,100 psi per ASTM C947. Finish: Exterior latex paint suited for concrete applications.

2. Precast Concrete Products: Wet-cast solid, molded concrete with an average compressive strength of 5,000 psi per ASTM C39. Unit weight range of about 115-145 lbs per cubic foot. Finish: Exterior latex paint suited for concrete applications.

1.9 POLYETHYLENE PARTS

A. Recycled Permalene Parts shall be manufactured from 3/4" high-density polyethylene that has been specially formulated for optimum UV stability and color retention. Products shall meet or exceed density of .960 G/cc per ASTM D1505, tensile strength of 2400 PSI per ASTM D638. Available in a three-layer product with (2) .100" thick colored exterior layers over a .550" thick recycled Black interior core. Standard colors are available.

1.10 FOOTINGS

A. Unless otherwise specified, the bury on all footings shall be 34" below Finished Grade (FG) on all in-ground play events/posts. Other types of anchoring are available upon request.

1.11 HARDWARE PACKAGES

A. All shipments shall include individual component-specific hardware packages. Each hardware package shall be labeled with the part number, description, a component diagram showing the appropriate component, package weight, a bar code linking the hardware package to the job number, assembler's name, date and time the package was assembled, work center number and work order number.

1.12 INSTALLATION DOCUMENTATION

A. All shipments shall include a notebook or packet of order-specific, step-by-step instructions for assembly of each component, including equipment assembly diagrams, estimated hours for assembly, footing dimensions, the concrete quantity for direct bury components, fall height information, area required information, and detailed material specifications.

1.13 PACKAGING

A. All shipments shall include a packing list for each skid/container, specifying the part numbers and quantities on each skid or within each container.

B. All components shall be individually wrapped or bulk wrapped and placed on skids (pallets) then shrink-wrapped to provide protection during shipment. Small parts and hardware packages will be placed in crates for shipment. Other components shall be individually wrapped or bulk wrapped to provide protection during shipment.

1.14 MAINTENANCE KIT

A. An order-specific maintenance kit shall be provided for each structure order. The kit will include a notebook or packet with a second set of installation documents and order-specific maintenance documentation with recommendations on how often to inspect, what to look for and what to do to keep the equipment in like-new condition

B. The kit also includes touch-up primer, appropriate color touch-up paint, sandpaper, appropriate color touch-up PVC and additional installation tools for the tamperproof fasteners.

PART 2- PRODUCTS

2.1 EVOS GENERAL SPECIFICATIONS

A. 5" Arches: All steel arches are ProShield finished and manufactured from 5" O.D. galvanized tubing with a wall thickness of .120".

B. Steel Arch Mechanical Properties:

1. Yield Strength (min): 50,000 PSI
2. Tensile Strength (min): 55,000 PSI
3. Elongation: 25% in 2 inches
4. Modulus of Elasticity: 29.5 x 106 PSI

C. 5" Clamps: All clamps are ProShield finished and, unless otherwise noted, shall be sand cast using a 356-T6 aluminum alloy and having the following mechanical properties:

1. Ultimate Tensile: 35,000 PSI
2. Yield Strength: 18,000 PSI
3. Elongation: 8% in 2 inches

D. Steel-reinforced cables: Made of tightly woven, polyester-wrapped, six-stranded galvanized steel cable. These abrasion-resistant, color-stable cables are extremely durable and vandal resistant. Standard colors are available.

2.2 WEEVOS GENERAL SPECIFICATIONS

I. 3-1/2" Arches: All steel arches are ProShield finished and manufactured from 3-1/2" O.D. galvanized tubing with a wall thickness of .120".

J. Steel Arch Mechanical Properties:

1. Yield Strength (min): 50,000 PSI
2. Tensile Strength (min): 55,000 PSI
3. Elongation: 25% in 2 inches
4. Modulus of Elasticity: 29.5 x 106 PSI

K. 3-1/2" Clamps: All clamps are ProShield finished and, unless otherwise noted, shall be sand cast using a 356-T6 aluminum alloy and having the following mechanical properties:

1. Ultimate Tensile: 35,000 PSI
2. Yield Strength: 18,000 PSI
3. Elongation: 8% in 2 inches

L. Steel-reinforced cables: Made of tightly woven, polyester-wrapped, six-stranded galvanized steel cable. These abrasion-resistant, color-stable cables are extremely durable and vandal resistant. Standard colors are available.

2.3 PLAYBOOSTER GENERAL SPECIFICATIONS

A. Posts: Post length shall vary depending upon the intended use and shall be a minimum of 42" above the deck height. All posts shall be ProShield finished to specified color. All posts shall have a “finished grade marker” positioned on the post identifying the 34" bury line required for correct installation and the top of the loose fill protective surfacing. Top caps for posts shall be aluminum die cast from 369.1 alloy and ProShield finished to match the post color. All caps shall be factory installed and secured in place with interference fit. A molded low-density polyethylene cap, with drain holes, shall be pressed onto the bottom end of the post to increase the footing area.Steel Posts

B. Steel Posts

1. All steel PlayBooster posts are manufactured from 5" O.D. tubing with a wall thickness of .120" and shall be galvanized after rolling and shall have both the I.D. and the cut ends sprayed with a corrosion resistant coating.
2. Steel Post Mechanical Properties:

cc. Yield Strength (min): 50,000 PSI

dd. Tensile Strength (min): 55,000 PSI

ee. Elongation: 25% in 2 inches

ff. Modulus of Elasticity: 29.5 x 106 PSI

C. Aluminum Posts

1. All aluminum PlayBooster posts are manufactured from 6005-T5 extruded tubing conforming to ASTM B-221. Posts shall have a 5" outside diameter with a .125" wall thickness.2. Steel Post Mechanical Properties:
2. Aluminum Post Mechanical Properties:
    a. Yield Strength (min): 50,000 PSI
    b. Tensile Strength (min): 38,000 PSI
    c. Elongation: 10% in 2 inches
    d. Modulus of Elasticity: 10 x 106 PSI

D. Arch Posts: Aluminum arch posts shall be manufactured from 6005-T5 alloy. The arch shall be formed to a 21" center line radius to complement the 42" center-to-center module. The arch shall be of one continuous piece construction. There shall be no welds or additional pieces mechanically fastened to manufacture the arch. Each arch shall be designed to provide a minimum of 90 1/2" clear span from the deck to the inside of the arch at the radius peak. Arches shall be ProShield finished to a specified color.

E. Clamps
1. All clamps are ProShield finished and, unless otherwise noted, shall be die cast using a 369.1 aluminum alloy and have the following mechanical properties:
    a. Ultimate Tensile: 47,000 PSI
    b. Yield Strength: 28,000 PSI
    c. Elongation: 7% in 2 inches
    d. Shear Strength: 29,000 PSI
    e. Endurance Limit: 20,000 PSI
2. Each functional clamp assembly shall have an appropriate number of half clamps and shall be fastened to mating parts with (2) 3/8" x 1 1/8" pinned button head cap screws (SST) and (2) stainless-steel (SST) recessed “T” nuts. A 1/4" aluminum drive rivet with stainless steel pin is used to ensure a secure fit to the post.
3. PlayBooster clamps have three functional applications and shall be named as follows:
    e. Offset hanger clamp assembly
    f. Deck hanger clamp assembly
    g. Hanger clamp assembly.
4. Netplex Clamps: All clamps are ProShield finished and, unless otherwise noted, shall be die cast using a 369.1 aluminum alloy and have the following mechanical properties:
    a. Ultimate Tensile: 47,000 PSI
    b. Yield Strength: 28,000 PSI
    c. Elongation: 7% in 2 inches
    d. Shear Strength: 29,000 PSI
    e. Endurance Limit: 20,000 PSI
5. Each functional clamp assembly shall have an appropriate number of rope clamps and back clamps and shall be fastened to each other with (2) 5/8" x 1 1/2" pinned button head cap screws (SST) and (2) stainless-steel (SST) recessed “T” nuts. Either a face clamp shall be fastened to rope clamp with (2) 3/8" by 1-3/8" pinned button head cap screws or a single tab casting plate shall be fastened to rope clamp with (4) 3/8" by 1-3/8" pinned button head cap screws with 3/8" SAE flat washers. A 1/4" x 5/8" aluminum drive rivet with stainless steel pin is used to ensure a secure fit to the post.
6. Geoplex Clamps: All clamps are ProShield finished and, unless otherwise noted, shall be fabricated from 7GA using .179" (4,54 mm) T316 stainless steel.

a. Ultimate Tensile: 84,000 PSI

b. Yield Strength: 25,000 PSI

7. Each functional clamp assembly shall have an appropriate number of locking clamps and shall be fastened to mating parts with (2) 3/8" x 7/8" pinned button head cap screws (SST) with (2) 3/8" SAE flat washers. A 1/4" aluminum drive rivet with stainless steel pin is used to ensure a secure fit to the post.

8. Steel-reinforced cables: Made of tightly woven, polyester-wrapped, six-stranded galvanized steel cable. These abrasion-resistant, color-stable cables are extremely durable and vandal resistant. Standard colors are available. Some products available in Black only.

2.4 PLAYODYSSEY STRUCTURAL FRAME

A. Post length of the double ladder/central column shall vary depending upon the deck height and shall be flush with the bottom of a deck infill or a minimum of 46" above the deck height. All posts shall be ProShield finished to specified color. All posts shall have a "finished grade marker" positioned on the post identifying the 60" bury line required for correct installation and the top of the loose fill protective surfacing. Post caps shall be aluminum die cast from 369.1 alloy and ProShield finished to match the post color. All caps shall be factory installed and secured in place with (3) self sealing rivets. A molded low-density polyethylene cap, with drain holes, shall be pressed onto the bottom end of the ladder posts to increase the footing area. Ladders are bolted together below grade to act as a single column for installation purposes. The deck support weldments/arms are comprised of 5/16" (.313") steel conforming to 1010 steel per ASTM A635 and welded to a 52" steel post. Arms are secured to each ladder post with (4) 5/8" x 1 1/2" pinned button head cap screws through (2) 1/4" flanges.

B. PlayOdyssey Optional Aluminum Roof Posts: All formed aluminum PlayOdyssey roof posts are manufactured from 6005-T5 extruded tubing conforming to ASTM B-221. Posts shall have a 5" outside diameter with a .125" wall thickness. Post sleeve shall have 4.675" outside diameter with a 150" wall thickness. Post cap shall be aluminum die cast from 369.1 alloy and ProShield finished to match the post color. All caps shall be factory installed and secured in place with (3) self-sealing rivets.

2.5 VIBE

A. Vibe Handholds: Rotomolded shell, with 7 GA (.179") HRPO steel sheet insert that is zinc plated then ProShield finished. Standard colors are available.

B. Vibe Roof: Rotomolded shell, with 12 GA (.105") HRPO steel sheet insert that is zinc plated then ProShield finished. Standard colors are available.

C. Vibe Enclosures: Rotomolded shell, with 7 GA (.179") HRPO steel sheet insert that is zinc plated then ProShield finished. Standard colors are available. Option of 10 activity panels available in standard Permalene® colors. Also available bubble or window panel made of 1/4" clear polycarbonate

2.6 PLAY SHAPER GENERAL SPECIFICATIONS

A. 32 3/8" square aluminum posts shall have a minimum wall thickness of .125" and be extruded of 6005-T5 aluminum alloy and have rounded corners and ribbed faces for maximum safety. A cast aluminum top cap shall be installed at the factory with stainless steel knurled spacers and aluminum drive rivets. Flanges for panels and deck supports shall be extruded of 6061-T6 aluminum alloy and slide into slots extruded in posts. Flanges and deck supports shall be attached in the factory with stainless steel knurled spacers and aluminum drive rivets. All direct bury posts shall have a "finished grade marker" positioned on the post identifying the 34" bury line and the top of the required surfacing. A molded low-density polyethylene cap, with drain holes, shall be pressed onto the bottom end of the post to increase the footing area. Posts shall have a post number sticker for installation purposes. All surface mount posts shall be continuously welded to a 1/4" x 6" square 6061-T6 aluminum surface mount plate and allow for 2" of protective surfacing. Posts shall be ProShield finished to a specified color.2" of protective surfacing. Posts shall be ProShield

finished to a specified color.

B. Aluminum Post Mechanical Properties:

1. Yield Strength (min): 35,000 PSI
2. Tensile Strength (min): 38,000 PSI
3. Elongation: 10% in 2 inches
4. Modulus of Elasticity: 10 x 106 PSI

C. Arch posts shall have the same shape as the posts and be extruded from 6063-T4 aluminum alloy. Roof support flanges shall be of the same shape and material as the panel flanges. Arch shall be formed in a 180 degree arc on a 21" center line radius. Arches shall be secured to standard length posts with solid aluminum sleeves that are tapped to receive (16) 3/8" x 5/8" pinned button head cap screws per arch. Arch posts shall be ProShield finished to a specified color.

END OF SECTION

SECTION 123616 – METAL COUNTERTOPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Textured metal fabrications for the following applications:

1. Metal countertops.

1.2 RELATED SECTIONS

Not used.

1.3 REFERENCES

A American Society for Testing and Materials (ASTM): ASTM A 240 -Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

B. American Society for Testing and Materials (ASTM): ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. National Association of Architectural Metal Manufacturers (NAAMM): NAAMM Metal Finishes Manual for Architectural and Metal Finishes.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2, Description of materials, finishes, and construction.

3. Storage and handling requirements and recommendations.

4. Installation methods.

5. Maintenance methods.

6. Cleaning methods.

C. Shop Drawings: Submit shop drawings showing plans, sections, and elevations. Show edge conditions, attachment to other work, profiles and finishes of each metal member, and joinery to other metal members and to adjacent work. Show mounting types, heights, anchorage methods, and attachment devices.

D. Selection Samples: For each finish product specified, two complete sets of pattern samples representing manufacturer's full range of available finishes and patterns.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in accordance with manufacturer's requirements.

B. Store products in manufacturer's unopened packaging with labels intact until ready for installation.

1.6 PROJECT CONDITIONS

A. Environmental Requirements: 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. Existing Conditions: Field measure to verify dimensions before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Rigidized Metals Corp., which is located at: 658 Ohio St.; Buffalo, NY 14203; Toll Free Tel: 800-836-2580; Tel: 716-849-4760; Fax: 716-849-0401; Email:request info (bethneel@rigidized.com); Web:www.rigidized.com

B. Substitutions: Or approved equal.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 APPLICATIONS

A. Metal Countertops: Metal countertops shall be custom fabricated from 16 gauge 304 stainless steel and laminated to two plywood sheets to achieve 1-1/2 inches (38 mm) countertop height with cut outs for sinks and fixtures. Surface sheet metal to wrap around bottom of counter 1/2 inch (12 mm). Manufactured by Rigidized Metals Corporation, 658 Ohio Street Buffalo New York 14203 (800) 836-2580.

1. Finish: No. 4 finish.
2. Finish: Texture as selected.
3. Laminated to 3/4-inch (19 mm) fire rated particle board with 0.048 inch (1.21 mm) galvanized metal backer.
4. Backsplashes: Manufacturer's standard with cut outs for electrical outlets and service fixtures.
    a. Divider Bar: T molding as indicated or required.
    b. Cap Strip: J molding as indicated or required.
    c. Inside corner molding as indicated or required.
    d. Outside corner molding as indicated or required.

2.3 MATERIALS

A. Material: Stainless Steel 304 grade.

1. Finish: No. 4 ("satin" polish directional finish).

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

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install ornamental formed metal materials plumb, square, and rigidly coupled and adequately anchored, maintaining uniformed clearances and accurate alignment.

C. Restore damaged finishes that require field cutting, welding, or grinding.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

C. Restore manufacturer's protective films and coverings damaged during installation.

END OF SECTION

SECTION 126613 – TELESCOPIC SEATING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Telescopic Gym Seating includes electrically operated multiple-tiered seating rows comprising of seat, deck components, understructure that permits closing without requiring dismantling, into a nested configuration for storing or for moving purposes.

1. Wall-attached telescoping stands

B. Related Sections:

1. Retain those sections below which cross reference information related to this section in project manual.
2. Division 26 Electrical sections for electrical wiring and connections for electrically operated telescoping stands.

1.2 REFERENCES

A. Florida Building Code 2020 latest Edition.

B. Florida Building Code Accessibility 2020 latest Edition.

C. Aluminum Association (AA):

1. ADM 1- Aluminum Design Manual

D. American Institute of Steel Construction (AISC):

1. AISC 360- Steel Construction Manual.

E. American Iron & Steel Institute (AISI):

1. AISI S100 – Design of Cold Formed Steel Structural Members.

F. American Society for Testing Materials (ASTM):

1. ASTM - Standard Specifications for Properties of Materials.

G. American Wood Council (AWC):

1. ANSI/AWC NDS (National Design Specification for Wood Construction).

H. American Welding Society (AWS):

1. AWS D1.1 Structural Welding Code – Steel
2. AWS D1.3 Structural Welding Code - Sheet Steel

I. Canadian Welding Bureau: CWB Division 3 W47.1

J. U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

K. Forest Stewardship Council:

1. Chain of Custody Certification (FSC-STD-40-004)

L. International Building Code (IBC) Latest edition.

M. International Code Council (ICC) Latest edition.

1. ICC 300: Standard for Bleachers, Folding and Telescopic Seating and Grandstands.

N. National Fire Protection Association (NFPA):

1. NFPA 101 latest current edition with latest amendments.
2. NFPA 5000 latest current edition with latest amendments. Building Construction and Safety Code
3. NFPA 70: National Electrical Code.

O. National Institute of Standards and Technology (NIST)

1. PS 1: Structural Plywood. All wood in concealed spaces must be fire rated.

P. Southern Pine Inspection Bureau (SPIB):

1. SPIB: Standard Grading Rules for Southern Pine. All wood in concealed spaces must be fire rated.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate and install telescopic gym seating systems to the following structural loads without exceeding allowable design working stresses of materials involved, including anchors and connections. Apply each load to produce maximum stress in each respective component of each telescoping stand unit according to ICC 300 latest current edition with latest amendments or updates.

B. Manufacturer's System Design Criteria:

1. Gymnasium seat assembly: Design to support and resist, in addition to its own weight, the following forces:
   a.) Live load of 120 lbs. per linear foot (1.75 kN/m) on seats and decking
   b.) Uniformly distributed live load of not less than 100 psf (4.79 kN/m^2) of gross horizontal projection.
   c.) Parallel sway load of 24 lbs. per linear foot (0.35 kN/m) of row combined with (b.) above
   d.) Perpendicular sway load of 10 lbs. per linear foot (0.15 kN/m) of row combined with uniformly distributed live load above.
   e.) Parallel and Perpendicular sway loads are not applied concurrently.
2. Hand Railings, Posts and Supports: Engineered to withstand the following forces applied separately:
   a.) Concentrated load of 200 lbs. (0.89 kN) applied at any point and in any direction.
   b.) Uniform load of 50 lbs. per foot (0.73 kN/m) applied in any direction.
3. Guard Railings, Post and Supports: Engineered to withstand the following forces applied separately:
   a.) Concentrated load of 200 lbs. (0.89 kN) applied at any point and in any direction along top rail.
   b.) Uniform load of 50 lbs. per foot (0.73 kN/m) applied in any direction at top rail

c.) Uniform load of 50 lbs. (0.22 kN) applied on an area equal to 1 ft^2 (0.09 m^2) applied on all guardrail infill panels.

1.4 ACTION SUBMITTALS

A. Product to be supplied shall have a current evaluation report issued by ICC Evaluation Services (ICC-ES) certifying that it meets all structural design requirements of the current ICC 300 Standard for Bleachers, Folding and Telescopic Seating, and Grandstands, including all specified load combinations.

B. Provide Current Welding Certification[s] AWS or CSA.

C. Provide Manufacturers Certification of Insurance coverage of not less than $5,000,000 and Errors and Omission Insurance of not less than $2,000,000

D. Provide Installer Name, Current Certification Number and Product Qualifications

E. Provide Manufacturers' standard warranty documents.

F. Shop Drawings: For telescoping stands in both stacked and extended positions. Show seat heights, row spacing and rise, aisle widths and locations, assembly dimensions, anchorage to supporting structure, material types and finishes.

1. Electrical: Indicate power supply requirements.
2. Graphic Drawing Proofs & Layouts

G. Samples: For units with factory-applied finishes.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For telescopic bleacher to include video operations manual.

1.6 QUALITY ASSURANCE

A. Manufacturer shall be a current Certified Welding Fabricator as defined by either AWS or CWB, or both. The manufacturer shall comply with structural welding codes that are applicable to their products or materials. These welding codes shall be produced by AWS or CSA

B. Product to be supplied shall have a current evaluation report issued by ICC Evaluation Services (ICC-ES) certifying that it meets all structural design requirements of the current ICC 300 Standard for Bleachers, Folding and Telescopic Seating, and Grandstands, including all specified load combinations.

C. Electrical components, devices, and Accessories shall be listed and labeled as defined in NFPA 70, by a qualified testing agency and marked for intended location and application.

D. Installer Qualifications: Factory trained and certified by the manufacturer.

E. Seating Layout: Provide telescoping stands to comply with ICC 300 current latest edition Standard for Bleachers, Folding and Telescopic Seating, and Grandstands, except where additional requirements are indicated or imposed by authorities having jurisdiction.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver telescoping stands in manufacturers packaging clearly labeled with manufacturer name and content.

B. Handle bleacher equipment in a manner to prevent damage.

C. Deliver the telescoping stands at a scheduled time for installation that will not interfere with other trades operating in the building when at all possible.

1.8 PROJECT CONDITIONS

A. Field Measurements: Coordinate actual dimensions of construction affecting telescoping stands installation by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid delay of Work.

1.9 WARRANTY

A. Manufacturer's Warranty: Includes the repair or replacement of the defective product; or defective component thereof, with a comparable product; or component thereof, or a refund of the purchase price prorated over the warranty period.

1. Includes: Labor, materials, and freight for replacement or repairs.
2. Structural Component parts of Understructure Warranty Period: 10 years from Date of Acceptance
3. Decking systems, seating collections, electrical, portable, and integral dolly systems, end closure curtains, surface material finishes Warranty Period 5 years from Date of Acceptance.

PART 2 PRODUCTS

A. Wood:

1. Lumber: NIST PS 20, southern pine complying with SPIB's "Standard Grading Rules for Southern Pine Lumber" for B&B Finish (B and better) grade-of-finish requirements.
2. Plywood: NIST PS 1, APA-grade trademarked, A-C grade.

B. Steel:

1. Structural-Steel Shapes, Plates, and Bars: ASTM A36.
2. Galvanized-Steel Sheet: ASTM A653, Grade 40 (276 MPa) coating designation G60.
3. Uncoated Steel Strip; Non-Structural Components: ASTM A1011, Commercial Quality, Type B, Hot-Rolled Strip.
4. Uncoated Steel Strip; Structural Components: ASTM A1011 Grade 33 (228 MPa), Grade 36 (249 MPa), Grade 40 (276 MPa), Grade 45 (311 MPa), or Grade 50 (345 MPa), Structural Quality, Hot-Rolled.
5. Galvanized Steel Strip: ASTM A653 Grade 40 (276 MPa) or Grade 64 (441 MPa), structural quality, coating designation G60.
6. Tubing: ASTM A500, cold formed; Grade B, or ASTM A513, 46 ksi min yield.

C. Polyethylene Plastic: High-density polyethylene; injection molded, color-pigmented, textured, impact-resistant, and dimensionally stable.

2.2 MANUFACTURERS

A. Manufacturer: Hussey Seating Company, U.S.A.

1. Address: North Berwick, Maine, 03906.
2. Telephone: (207) 676-2271; Fax: (207) 676-9690.
3. Product: MAXAM Telescopic Gym Seat System.

B. Substitutions: Or approved equal with matching warranties, finishes and accessories.

2.3 TELESCOPING STANDS

A. Wall-Attached Telescoping Stands: Forward-folding system with the rear of the understructure permanently attached to the floor and to the rear wall. Rear wall provides structural support and must support loads imposed by the bleacher.

2.4 DIMENSIONAL AND OPERATIONAL CRITERIA

A. Dimensions:

1. Row Spacing: 24 inches (610 mm)
2. Row Rise: 9-5/8 inches (244 mm)

B. Operation: Integral Power

1. Integral Power: Pendant control unit
   a.) Limit Switches: Automatically stop integral power system when telescoping stands reach fully opened or closed positions.

2.5 SEATING

A. Polymer Seat System: Courtside Collection XC10

1. Material: Gas assist injection-molded, 100 percent recyclable HDPE, high density polyethylene.
2. Module Size: 18 inches (457 mm) long by 10 inches (254 mm)
3. Module Load: Tested to 600 lbs. (2.67 kN).
4. Seat height range from deck to top of seat: 16-1/8 inches (410 mm)
5. Integrally molded end caps at aisle end locations.
6. Integrally molded recess pockets to accept seat number and row letters.
7. Integrally molded rear closure panel at back of seat to allow for "continuous clean sweep" of debris at deck level and minimized visibility of structural ribbing.
8. Color: As selected by Architect from manufacturers 15 standard colors

B. ADA Accessible Seating:

1. Locate first tier modular units to provide wheelchair-accessible seating at locations indicated on Drawings.
   a.) Flex-Row™: Provide first row modular recoverable seating units that can be closed to accommodate persons requiring ADA spaces (or any other temporary

space needs) or opened for standard usage. Each Flex-Row unit shall have a handle for easy operation.

1.) Provide a black full-surround steel skirting with no more than ¾" floor clearance for safety and improved aesthetics.

2.) Provide a black injection molded end cap for the nose beam for safety and improved aesthetics.

3.) Provide a mechanical positive lock when the Flex-Row system is in both the open and closed position. Handle shall unlock the modular recoverable seating unit for operation.

4.) Flex-Row can be utilized with the full system in the open or closed position.

5.) Flex-Row modular units are designed to achieve multi-use front row seating to accommodate team seating, ADA requirements and facility specific requirements. Flex-Row units are available in modular units from 2 to 7 seats wide as well as full section widths.

2.6 RAILS, PANELS AND STEPS

A. End Rails:
   1. Self-storing
      a.) Provide steel self-storing starting no higher than tier 2 42 inches (1066mm) high above seat, end rail with tubular supports and intermediate members designed with 4 inch (102mm) sphere passage requirements.
   2. Material and Finish: powder coated steel.
   3. Color: Grey. Final color to be selected by City.

B. Center Aisle Rails:
   1. Auto-Rotating
      a.) Provide single pedestal mount handrails 34 inches high with terminating mid rail. Permanently attached handrail shall rotate in a permanently mounted socket for rail storage. Rail shall automatically rotate, lock in the use position, unlock and rotate back to the stowed position as the gym seats open and close. Ends of the handrail shall return to the post, and not extend away from it. Rails having openings to avoid interference with closed decks are not acceptable
   2. Color: Grey. Final color to be selected by City.

C. Fixed Front Closure Panels: Panels extend vertically from the underside of front row to within 1-1/2 inches of floor.
   1. Material: 5/8 inch Polydeck attached to a powder coated steel framework.
   2. Color: Gray – Final color to selected by City from standard color pallet.

D. Fixed Rear Closure Panels: Panels extend vertically from underside of front row to up to 8 feet high within 1-1/2 inches of floor.
   1. Material: Polydeck, min. 5/8 inch attached to a powder coated steel framework.

2. Color: Grey - Final color to selected by City from standard color pallet.

E. End Closure Panels: For closed stack position at each exposed bank end.

1. Material: Polydeck min. 5/8 inch attached to a powder coated steel framework].
2. Color: Grey Final color to selected by City from standard color pallet

F. Steps

1. Sure-Step (Flip-up Front Aisle Step): Permanently hinged to the front row to ensure availability and ease of operation. Two 3" diameter x ¾" wide non-marking front wheels are provided so that the system can be operated with the Sure-Step in the stored or deployed position. All edges coined, hemmed or radiused with front edge protective rubber bumpers. Abrasive-backed non-slip tread identifier on leading edge of nosing. For aisle widths greater than 6'-0", two side by side hinged steps are provided.

2.7 COMPONENTS

A. Decking

1. Plywood
   a.) 5/8 inch (16 mm) thick AC grade tongue and groove Southern Yellow Pine with clear urethane, high gloss finish.

B. Understructure:

1. Finish: Rust-inhibiting black finish
2. Hardware finish: Zinc-plated, Rust inhibiting black finish
3. Posi-locks and other surfaces: Powder coated black, Rust inhibiting black finish
4. Nose beam and Rear Riser beam: Nose beam shall be continuously roll-formed closed tubular shape of ASTM A653 grade 40 (276 MPa). Riser beam shall be continuously roll-formed of ASTM A653 Grade 64 (441 MPa). Nose and Riser beam shall be designed with no steel edges exposed to spectator after product assembly. Nose beam and riser beams are through-bolted fore/aft to deck stabilizers and frame cantilevers to create the deck structure.
5. Frame: The frames are welded assemblies (one left hand, one right hand per tier) comprised of the following components:
   a.) Lower Track subassembly: ASTM A1011 Grade 50: Continuous Positive Interglide System (casterhorn) interlocks each adjacent frame casterhorn using an integral, continuous, anti-drift feature and captive interlock with adjustable row spacing at front to prevent separation and misalignment.
   b.) Lower Track Wheels: 3 per frame Not less than 5 inches diameter by 1-1/4 inches with non-marring soft rubber face to protect wood and synthetic floor surfaces, with molded-in sintered iron oil-impregnated bushings to fit 3/8 inch diameter axles secured with E-type snap rings.
      1.) Option: up to 6 wheels per frame for load distribution
   c.) Slant Columns: A500 Grade B, tubular shape.
   d.) Cantilever Subassembly: Consists of ASTM A1011 Grade 50 nose connection plate, cantilever, and riser attachment plate welded together into a subassembly.

6. Lock system: Casterhorns at the end sections of powered banks (minimally), and manual sections, contain a Low Profile Posi-Lock LX to lock each row in open position and allow unlocking automatically. Provide adjustable stops to allow field adjustment of row spacings.
7. Sway Bracing: ASTM A653 grade 40 (276 MPa), tension members bolted to columns.
8. Deck Stabilizer: A1011 Grade 45, member through-bolted to nose and riser at three locations per section. Securely captures front and rear edge of decking at rear edge of nose beam and lower edge of riser beam for entire length of section. Interlocks with adjacent stabilizer on upper tier using low-friction nylon roller to prevent separation and misalignment.

C. Fasteners: Vibration proof, in manufacturer's standard size and material.

2.8 ELECTRICAL OPERATION SYSTEMS

A. Integral Power

1. Default operation shall be with a removable pendant control unit which plugs into seating bank for tethered operator management of stop, start, forward, and reverse control of the power operation. Other modes of operation are optional.

B. PF1/2/3/4: Furnish and install Hussey PF(1/2/3/4), an integral automatic electro mechanical powered frame propulsion system, to open and close telescopic seating.

1. Electrical - Seating Manufacturer shall provide all wiring within seating bank, including pendant control. Motors, housing, and wiring shall be installed and grounded in complete accord with the National Electrical Code. The control system shall operate at low voltage (24V). The electrical contractor shall perform all connections at and upstream of the equipment specified herein and ensure that supplied voltage drops no more than 4% below nominal where power connects thereto.
2. Each unit for PF(1/2/3/4) is driven by a 1/2 horsepower, 1725 RPM motor.
   a.) 208V 3 Phase:
      1.) This 1.25 Service Factor motor runs on 208V at 60 Hz and draws a full load current of 1.8 amperes. The required power supply shall be 3 asynchronous phases of 120 Volts each, plus neutral plus ground, each with 20 Amp capacity.
      2.) This system shall be UL Listed in its entirety (motors, circuit protection, motor controls, user interface, enclosures, conductors and connectors all evaluated and approved for correct sizing and compatibility under maximum rated load on the motors) under UL Product Category FHJU, titled Electrical Drive and Controls for Folding and Telescopic Seating.
3. Annual Service Light
   a.) The annual service light unit is a low voltage (24V) system that is integrated into the electrical control system on a powered bleacher.
      1.) This system shall be UL Listed under UL Product Category FHJU, titled Electrical Drive and Controls for Folding and Telescopic Seating (UL File No. E467277).
   b.) This unit serves two main functions:

1.) Keep a continuous timer running that will indicate to the end user that an annual inspection of the bleacher is required.
    a.) The unit will retain the counting data for no less than 6 months without power.
    b.) There will be a light illuminated at the front of the bleacher once the counter reaches one calendar year.
    c.) The counter and light can be reset by authorized personnel once an inspection has been completed.
2.) Record the forward, reverse, and total operating time of bleacher.
    a.) This data can be viewed at any time from inside of the unit.

c.) Manufacturer shall furnish parts and instructions for installing an annual service light unit on the primary seating bank.

2.9 FABRICATION

A. Fabricate understructure from structural-steel members in size, spacing, and form required to support design loads specified in referenced safety standard.

B. Weld understructure to comply with applicable AWS standards.

C. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.

D. Form exposed sheet metal with flat, flush surfaces, level and true in line, and without cracking and grain separation.

2.10 GRAPHICS

A. CourtSide Graphic Logo: Decorative graphic logo that is applied to the applied to the integrally molded end cap recess area of the CourtSide 12XC seat module.

1. Logo is approximately 4.7 inches x 3.5 inches with full color.
2. Logo is trimmed to a precise custom cut shape with two mounting holes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas where telescoping stands are to be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Tolerances:

1. Flooring [and rear wall]: Level [and plumb] within 1/8 inch in 8 feet.

2. Maximum bleacher force on the floor of a 27 foot section: Static point load of less than 300 psi (2068 kN/m^2).

B. Install telescoping stands to comply with referenced safety standard and manufacturer's written instructions.

C. ADJUSTING AND CLEANING

D. On completion of installation, lubricate, test, and adjust each telescoping stand unit so that it operates according to manufacturer's written operating instructions.

E. Clean installed telescoping stands on exposed surfaces. Touch up shop-applied finishes or replace components as required to restore damaged or soiled areas.

3.3 MAINTENANCE SERVICE

A. Service Capability: Show proof of full-time service capability by factory certified technicians directly employed by the installer.

1. A four to eight-hour maximum on-site repair response is required during normal working hours, 8 a.m. to 5 p.m. weekdays (excluding holidays).
2. All Full Time Service Personnel shall be Factory Authorized and Trained.
3. Provide proof of Service Capability and a list of service parts regularly maintained in inventory.

3.4 DEMONSTRATION

Contractor to schedule a factory-authorized service representative to train City's maintenance personnel to adjust, operate, and maintain telescoping stands. Also provide video recording of training.

END OF SECTION

SECTION 131100 - SWIMMING POOLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT and applicable parts of DIVISION 1 - GENERAL REQUIREMENTS, as listed in the Table of Contents, be included in, and made a part of this Section.

1.02 SUMMARY OF WORK *(for general guidance-not inclusive*)

A. Introduction

1. Provide labor, materials, equipment, and services necessary to construct the Leisure Pool and Competition Pool. This work must include the structure(s) and installation of pool finishes as well as products listed in Part 2 of Section 131100.

B. Work included in this section:

1. It is the intent of this section to place the entire responsibility for the construction of the pool(s) (including the construction of the pool shell(s)) under one vested CONTRACTOR. Under this section the Swimming Pool Contractor will provide but is not necessarily limited to the following:

a. Provide equipment and services required for erection and delivery onto the premises the equipment or apparatus provided. Remove equipment from premises when no longer required.

b. Layout, excavate, remove from the construction site, replace, and grade materials as required beyond the limits of excavation of the pool shell(s) to complete the work described in this section. Reference Division 31 - Earthwork.

c. Grade and replace load bearing or high plasticity index soil, pump and dewater as necessary to keep excavations free from water during construction and provide sub-surface drainage beneath the surge tank(s) as needed or required in the project geotechnical report. Reference Division 31 - Earthwork.

d. Provide and maintain proper shoring and bracing for existing utilities, sewers and building foundations where required for related excavations. Reference Division /31 - Earthwork.

e. Provide electrical conduit, wiring, junction boxes etc. to low voltage pool equipment within pool filter/chemical rooms per Division 26 - Electrical. (Low voltage is considered less than 110 V.)

f. Coordinate for required bonding and grounding of the pool shell, fittings, and equipment.

g. Provide necessary piping and valving as shown on the drawings and specified herein.

h. Provide individually sized housekeeping pads for each pool pump. Provide housekeeping pads for pool equipment as required in the drawings.

i. Provide the main drain hydrostatic relief system and a sight sump as shown on the drawings. Reference Division 31 - Earthwork.

j. Construct the cast in place or pneumatically applied concrete pool shell(s) and cast in place surge tank(s) as described in these specifications and detailed on the drawings, including reinforcement steel, inserts, fittings, fiberglass main drain sumps and embedded items (piping, anchors, etc.) for the pool(s) . Reference Division 3 - Concrete and Structural. Before commencing the placement of concrete, verify electrical bonding of the pool embedded items and reinforcing steel. Also, coordinate and arrange required electrical, plumbing and or building inspections. Backfill and compact fill around the pool structure, piping trenches and excavations required by this work. Reference Division 31 - Earthwork.

k. Provide a proprietary aggregate cementitious finish finish in the pool(s) with a slip resistant surface with a vertical tile band. Provide specialty tile for the gutter nosing, wall targets, floor lane markings, depth markings and warning signs, construction joint installation bands, zero entry trench and main drain bands, and other tile installation within the pool structures. Reference Section 131103 - Swimming Pool Tile - including the tolerance requirements for the concrete substrate.

l. Provide fully assembled cleaning and maintenance equipment for the pool(s) as specified herein.

m. Provide for the storage of pool related equipment, materials, and systems. Items are the responsibility of the CONTRACTOR until accepted by owner.

n. Obtain final acceptance by jurisdictional health department(s).

o. Start, test, calibrate and adjust mechanical equipment, electrical equipment, recirculation, chemical, and other supplied systems including deck, loose, maintenance, and safety equipment. Instruct the Owner's representative in the systems operation and maintenance as described herein.

p. Provide the geothermal heating system for the pool(s). Include piping, heat humps, wells and well pump, controls, gauges, thermostats, control valves and wiring required.

C. Related work specified in other sections:

1. Section 131101 – Swimming Pool Cast-In-Place Concrete
2. Section 131102 – Swimming Pool Shotcrete
3. Section 131103 – Swimming Pool Tile
4. Section 131104 – Swimming Pool Cementitious Finish
5. Section 131106 – Swimming Pool Timing System
6. The following work related to the swimming pools must be completed by other trades.

a. Provide, erect, and maintain necessary barricades, signs, lights, and flares for pool construction to protect workers and the public.

b. Provide and maintain proper shoring and bracing for existing utilities, sewers and building foundations where required for swimming pool related excavations. Reference Division 31 - Earthwork.

c. Provide the under-drain system beneath the pool(s) if required.

d. Provide sub-surface drainage beneath the pump pit and backwash pit. Reference Division 31 - Earthwork.

e. Construct pump pit and backwash pit including reinforcement, inserts, wall sleeves, anchors, access hatches, and fittings. Reference Division 3 - Concrete.

f. Prior to concrete pours, verify electrical bonding of the pool embedded items. Coordinate and arrange required electrical, plumbing and or building inspections that must be performed on embedded items. Reference Division 26 - Electrical.

g. Provide sanitary sewer and storm drain connections. Reference Division 22 - Plumbing.

h. Provide deck mounted anchors, sockets, and inserts for the pool(s) and coordinate construction locations for each.

i. Provide deck finish beyond perimeter tile band. Reference Division 9 - Finishes

j. Provide rules and regulations signage as required by code. Reference Division 1 - General Requirements.

k. Provide chlorine resistant caulking (sealant) and backer rod on pool decks. Reference Division 7 - Thermal and Moisture Protection.

D. Related work specified in Plumbing section. Reference Division 22 - /Plumbing. Work that must completed by others.

1. Provide trench drains and area drains on pool deck.

2. Provide sanitary sewer piping from the filter room including floor drains, sumps, and sump pump.

3. Provide water service to hose bibbs, flush hydrant boxes and auto-fill bypass to air gap above fill funnel(s). Provide the slow closing solenoid valve(s) in the bypass auto-fill piping.

4. Provide water meter on the fresh water supply line upstream of the manual fill valve and the slow closing solenoid valve.

E. Related work specified in Mechanical section. Reference Division 23 – HVAC. Work that must completed by others.

1. Provide air recirculation systems for pool related spaces.

F. Related work specified in Electrical sections. Reference Division 26 – Electrical. Work that must completed by others.

1. Provide power to the exhaust fans for the chemical rooms.

2. Provide motor starters, auxiliary contacts, magnetic relays, and other electrical control devices necessary for the complete operation of the pool systems. Provide power to Variable Frequency Drive pool pump starters and power from VFD to the pool pump motor.

3. Ground and bond pool structures, fittings, and equipment in accordance with Article 680 of the N.E.C. Test and verify that the system electrical ground is true and solid. Provide certification to this effort.

4. Obtain permits, inspections, and approvals of wiring including grounding and bonding of metal components associated with the pool in accordance with Local, State and National Electrical Codes.

5. Provide power, conduits, electrical boxes, and wiring for the Contractor/Owner provided electronic timing and scoreboard system with multi-sport capability for race swimming, and pace clock.

6. Provide power, conduits, electrical boxes, and wiring for the underwater lights and junction boxes.

7. Confirm electrical conduits that penetrate the pool shell are watertight and installed per N.E.C. Article 680.

1.03 QUALITY ASSURANCE

A. The specifications and drawings illustrate and detail two (2) swimming pool systems that are utilized for both competitive and recreational use. Certain technical aspects of the design are common only to pool systems planned for public use. Understanding these aspects, their functions and interaction through experience is vital to completing a successful operating system. It is a mandatory requirement that bidders will have achieved such experience as a prerequisite for bidding this project.

1. If the Contractor has not received prior written approval for this project or has not been included in the pre-approved list of Contractors, they must submit a list of projects meeting the aforementioned qualifications, including contact information of the General Contractor must be submitted for review and approval at least 10 days prior to bidding of the project. The Contractor must have completed at least five (5) public-use pools with individual water surface areas in excess of 4500 square feet and a depth of 12’-0” or more within the past 10 years.

2. The Contractor must submit prior to the start of construction the name of the on-site Project Superintendent including their relevant experience. The Contractor’s on-site Project Superintendent must have completed at least five (5) public-use pools with individual water surface areas in excess of 4500 square feet and a depth of 12’-0” or more within the past 10 years. A list of projects meeting the aforementioned qualifications, including contact information of the General Contractor as well as

Owner must be included with the experience submittal. Project Superintendent must not change on the project unless written authorization has been provided by the Architect and Owner.

3. The Owner reserves the right to reject a bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligation of the contract and to complete the work described or if the bidder does not have the qualifications stated herein. Subject to compliance with item 2 above on this specification.

4. The following bidders have been pre-approved. Bidders must meet the requirements listed above.

Acapulco Pools
1550 Victoria St. N.
Kitchener, Ontario N2B3EZ
Phone: 519 - 743-6357

Weller Pools
1821 South Orange Blossom Tral
P.O. Box 16008
Apopka, FL 32703
Phone: 407-880-8800

Sunbelt Pools
10555 Plano Rd.
Dallas, TX
Phone: 214-343-1133

1.04 REGULATORY AGENCY REQUIREMENTS AND ENGINEERING SERVICES

A. The system must comply with necessary pre-construction approvals obtained by the Owner and Owner's Consultants from local regulatory agencies governing the design and construction of public swimming pools.

B. Give necessary notices, obtain permits, and pay government fees, and other costs in connection with his work, including the filing of necessary as-built drawings, prepare documents and obtain necessary approvals of governmental departments having jurisdiction over their work. Obtain required certificates of inspection for his work and deliver same to the Owner and Owner's Consultants before requesting acceptance and final payment for the work.

C. Include in the work, without extra cost to the Owner, labor, materials, services, apparatus, or drawings in order to comply with applicable laws, ordinances, rules, and regulations, whether or not shown on drawings and/or specified.

1.05 COORDINATION AND CLARIFICATION

A. Coordinate with other contractors or subcontractors work relating to this section.

B. Must establish with other contractors or subcontractors, having related work in this section, that work necessary to complete the pool(s) as shown on the drawings and in the specifications is included in the base bid and alternates to the Owner.

C. If in doubt regarding the responsibility for work covered in this section and/or discovery of errors or omissions in the bidding documents, notify the Architect through channels established by the specifications and request a clarification ten (10) days prior to the bid date.

1.06 ALTERNATES

A. Review the description of the alternates in Division 1 and on the drawings for possible effect upon work in this section. Alternates related to the work in this section are described in this division and on the bid proposal form.

B. Pool Alternates – NO POOL ALTERNATES

1.07 CONTRACTOR'S ALTERNATE PROPOSAL

A. Submit bid to the owner based on materials, equipment and methods as specified in this Section. No substitutions of material will be allowed.

B. It is the intent of the contract documents to encourage competition. The base proposal must include the construction methods and equipment as specified and detailed. Proposed system substitutions must have prior written approval by the Architect.

C. If there is a deviation from the basis of design equipment, confirm that engineering criteria are appropriate for the substituted equipment.

D. Substitutions of specified construction methods and equipment must include a complete submittal as required by these specifications and drawings of appropriate scale incorporating required changes. Provide a list of at least ten (10) satisfactory installations comparable to this project that have been manufactured and installed under the manufacturer's current legal name. Submit a list of such projects with the name, address and current telephone number of the Owner's Operator and Architect of Record to the Architect on the bid date.

E. Changes or modifications to the Contract Documents that are not authorized by the architect are the sole responsibility of the Contractor.

1.08 SUBMITTALS

A. Submittals must be made in accordance with the requirements of Division 1 - General Requirements and in strict compliance with the following procedures and guidelines.

B. One (1) set of shop drawings and engineering data must be tabbed, indexed, and referenced to the specifications, compiled into an electronic submittal, and submitted in two stages. The first stage must include items for the pool shell(s), reference swimming pool structural specifications. The second stage must be for remaining items. Each section of items must be prefaced by a cover sheet listing the items submitted within the section. Electronic submittals must be organized, numbered, and submitted in the same format and order as the project specifications. Only complete sets will be reviewed.

1. Engineering data covering systems, equipment, structures, and fabricated materials, which will become a permanent part of the work under this contract, must be submitted for review. This data must include drawings and descriptive information in sufficient detail and scale to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorage and supports required; performance characteristics; fabrication and dimensions needed for installation and correlation with other materials and equipment. A certification, in writing, must be provided indicating that equipment will fit in the space allotted and as shown on the drawings.

2. Submittals regardless of origin must be stamped with the approval of the CONTRACTOR and identified with the name and number of this contract, CONTRACTOR'S name, and references to applicable specification paragraphs and contract drawings. Each submittal must indicate the intended use of the item in the work. When catalog pages are submitted, applicable items must be clearly identified. The current revision, issue number, and date must be indicated on drawings and other descriptive data.

3. The submittals will not be accepted from anyone but the CONTRACTOR. Submittals must be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

4. The CONTRACTOR'S stamp of approval is a representation that the CONTRACTOR accepts full responsibility for determining and verifying quantities, dimensions, field construction criteria, materials, catalog numbers and similar data, and that he has reviewed or coordinated each submittal with the requirements of the work and the contract documents.

5. Each submittal must include a statement prepared by the originator of the drawings and data, certifying compliance with the contract documents except for deviations, which are specifically identified.

6. Deviations from the contract documents must be identified on each submittal and must be tabulated in the CONTRACTOR'S letter of transmittal. Such submittals must, as pertinent to the deviation, indicate

essential details of changes by the CONTRACTOR (including modifications to other facilities that may be a result of the deviation) and required piping and wiring diagrams.

7. The CONTRACTOR must accept full responsibility for the completeness of each submission, and, in the case of a resubmission, must verify that exceptions previously noted have been considered. In the event that more than one resubmission is required because of failure of CONTRACTOR to respond to exceptions and rejections previously noted, CONTRACTOR must make further resubmissions in person at the consultant's office.

8. The need for more than one resubmission, or a delay in obtaining review of submittals, will not entitle the CONTRACTOR to an extension of the contract time unless delay of the work is directly caused by a change in the work authorized by a change order.

9. Review of drawings and data submitted by CONTRACTOR will cover only general conformity to the drawings and specifications, external connections and dimensions that affect the layout. Review does not indicate a thorough review of dimensions, quantities, and details of the material, equipment, device, or item shown. Review of submittals does not relieve CONTRACTOR from responsibility for errors, omissions, or deviations, or responsibility for compliance with the contract documents.

10. When the drawings and data are returned marked REJECTED, REVISE AND RESUBMIT or SUBMIT SPECIFIED ITEM, the corrections must be made as noted thereon and as instructed and six corrected copies (or one copy and one corrected reproducible copy) resubmitted.

11. Resubmittals must bear the number of the first submittal followed by a letter (A, B, etc.) to indicate the sequence of the resubmittal. Resubmittals must be indexed, tabbed, referenced to the specifications, and bound in a three-ring binder and submitted at one time.

12. When corrected copies are resubmitted, the CONTRACTOR must, in writing, direct specific attention to revisions and must list separately revisions made other than those called for on previous submissions.

13. When the drawings and data are returned marked NO EXCEPTIONS TAKEN or MAKE CORRECTIONS NOTED, no additional copies must be provided unless specifically requested to do so for record.

C. Permits, Receipts and Test Reports

1. Provide the Architect with copies of permits and receipts for fee payments.

2. Submit a sample format for each test report intended for use. Submit test reports required herein only on approved forms.

D. Include complete product data indexed, tabbed, and referenced to specifications with 8 ½" x 11" cover sheet covering:

1. Paragraph 2.01 - Overflow System

2. Paragraph 2.02 - Pumping Equipment

3. Paragraph 2.03 - Filtration Equipment

4. Paragraph 2.04 - Recirculation Fittings

5. Paragraph 2.05 - Piping Systems

6. Paragraph 2.06 - Chemical Treatment Systems

7. Paragraph 2.07 - Chemistry Monitoring and Control Systems

8. Paragraph 2.08 - Flow Meters

9. Paragraph 2.09 - Water Level Controllers

10. Paragraph 2.10 - Deck Equipment

11. Paragraph 2.11 - Loose Equipment

12. Paragraph 2.12 - Maintenance Equipment
13. Paragraph 2.13 - Safety Equipment
14. Paragraph 2.14 - Thermometers
15. Paragraph 2.15 – Swimming Pool Finishes
16. Paragraph 2.16 - Waterproofing
17. Paragraph 2.17 – Sealants
18. Paragraph 2.18 - Underwater Lights
19. Paragraph 2.19 - Water Features and Support Equipment
20. Paragraph 2.20 - Pool Covers
21. Paragraph 2.21 – Geothermal Pool Heaters

E. Include engineering/construction drawings for the pool structure.

1. Reference Division 3 - Concrete.

F. Include engineering construction drawings for pool piping.

G. Reference Section 131104 – Swimming Pool Cementitious Finish

H. Reference Section 131103 – Swimming Pool Tile

I. Reference Section 131106 – Swimming Pool Timing System

1.09 OPERATION AND MAINTENANCE MANUALS AND CLOSE-OUT SUBMITTALS

A. Detailed operation and maintenance information must be supplied for equipment requiring maintenance or other attention. The equipment supplier and/or CONTRACTOR must prepare an operation and maintenance manual for equipment. Parts lists and operating, and maintenance instructions must be provided.

B. Each operation and maintenance manual must include the following:

1. Equipment function and calibration, normal operating characteristics, and limiting conditions.
2. Assembly, installation, alignment, adjustment and checking instructions.
3. Operating instructions for startup, routine and normal operation, regulation, and control, shut down and emergency conditions.
4. One (1) copy of instructional videos.
5. Operating cycles must be specifically described in outline format and in referenced detail. A wall-mounted color-coded piping flow diagram must be provided in the pool equipment room. The diagram must be engraved on laminated plastic with color-coded piping to match color of coding on piping, and including valves identified with number on tags. The minimum size is 11-inch x 17 inch.
6. Include manufacturer recommended maintenance schedule, parts lists, piping diagram (to agree with wall mounted diagram) and trouble-shooting information for pool mechanical equipment.
7. Using reference to keyed valves and wall diagram, include specific written instructions for procedures that must be followed for the following:
    a. Emptying and refilling the pool(s) including de-watering during the period that the pool(s) will be empty.
    b. Water level control adjustment and chemical control operation.
    c. Normal surge tank operation and balancing.

d. Filter operation and backwashing; and

e. Super chlorination.

8. Lubrication and maintenance instructions.

9. Guide to “trouble-shooting”.

10. Parts list and predicted life of parts subject to wear.

11. Outline, cross section, and assembly drawings; engineering data and wiring diagrams.

12. Test data and performance curves, where applicable.

13. Specific written instructions for procedure for emptying and refilling the pool(s) including de-watering during the period that the pool will be empty. Provide a yellow warning sign 8-1/2 in. x 11 in., that must be mounted in the filter room, that reads:

WARNING
Prior to emptying Pool
Consult O & M Manuals for Procedures

Add another sign that reads:

Keep Caps, Plugs and Tops Tight Fitting to Prevent Escape of Fumes.

14. One set of applicable submittals must be included in each manual.

C. The operation and maintenance manuals must be in addition to instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by the CONTRACTOR.

D. Manuals and other data must be printed on heavy, first quality paper, 8-1/2 x 11-inch size with standard 3-hole punching and inserted in plastic covers. Drawings and diagrams must be reduced to 8-1/2 x 11 inches or 11 x 17 inches. Where reduction is not practical, larger drawings must be folded separately and placed in envelopes that are bound into the manuals. Each envelope must bear suitable identification on the outside.

E. Six (6) bound volumes of each manual must be submitted. Parts lists and information must be assembled in substantial manuals and permanent, three-ring or three-post binders. Material must be assembled and bound in the same order as specified, and each volume must have a table of contents and suitable index tabs.

F. Material must be marked with project identification. Non-applicable information must be marked out or deleted.

G. Shipment of equipment will not be considered complete until required manuals and data have been received.

H. Contractor must provide, assemble, and inventory all deck, loose, safety, and maintenance equipment including any loose mechanical equipment prior to the Owner taking possession of the pool(s). Contractor must provide a checklist that has been signed by the Owner verifying receipt of all items listed in Part 2 - Products.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original, unopened containers and crates with labels intact and legible.

B. Deliver materials in sufficient time and quantity to allow continuity of work and compliance with approved construction schedule.

C. Handle materials in a manner to prevent damage.

D. Store materials on clean raised platforms with weather protective coverings. Provide continuous protection of materials against damage or deterioration.

E. Remove damaged materials from site.

1.11 WARRANTIES

A. The CONTRACTOR warrants to the Owner and Architect that materials and equipment provided under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted, and that the work will conform with the requirements of the contract documents. Work not conforming to these requirements, including substitutions not properly approved and authorized will be considered defective. The CONTRACTOR'S warranty will exclude remedies for damage or defect caused by abuse, improper or insufficient maintenance, improper operations, modifications not executed by the CONTRACTOR or improper wear and tear under normal use. If required by the Architect, provide satisfactory evidence as to the kind and quality of materials and equipment.

B. The CONTRACTOR must agree to repair or replace defective or non-complying work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.

C. Warranties must be for a period of one year from the date of substantial completion or the owner begins using the pool unless otherwise specified. Submit warranties covering, but not limited to the following:

1. Defects in material or workmanship of the pool and surge/balance tank structure(s) causing a loss of water for a period of three (3) years.

2. Defects in material, manufacture and installation of the filtration, backwash, chlorination, pH adjustments and cleaning systems, including controls for a period of one (1) year.

3. Defects in material, manufacture or installation of the recirculating overflow system and interior coating of the gutter/trench for a period of one (1) year.

4. Manufacturer's minimum ten (10) year warranty against defective materials, components, and workmanship in the pool gutter grating system.

5. Defects in material, workmanship, and installation of the pool pumps for a period of one (1) year.

6. Manufacture’s minimum five (5) year labor and seven (7) year parts for the geothermal heating system. The titanium parts of the condenser and evaporator heat exchangers (coils) in the units have a lifetime parts warranty.

7. Manufacturer's minimum eighteen (18) month warranty against defective materials, components, and workmanship in the variable frequency drive system.

8. Manufacturer's minimum fifteen (15) year warranty on the filter tank against defective materials or workmanship of the tank and components. (Additional warranty time may be purchased from the manufacturer.) Prorated warranties are not acceptable.

9. Defects in material, workmanship, and installation of the pool piping system and recirculation fittings for a period of three (3) years.

10. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the sanitizing feed system.

11. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the pH buffer feed system.

12. Manufacturer's minimum five (5) year warranty against defective materials, components, and workmanship in the pool chemical controller. ORP, pH, flow and temperature sensors must be covered by a standard two (2) year warranty. Other sensors and flow cell components must be covered by a standard one (1) year warranty.

13. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the pool water level control system.

14. Defects in material, workmanship, and installation of loose, deck, maintenance, and safety equipment including deck anchors for a minimum period of one (1) year.

15. Defects in material, workmanship, and installation of the pool painted finish (zero entry) against delamination for a period of one (1) year.

16. Defects in material, workmanship, and installation of the pool cementitious finish against cracking and delamination for a period of three (3) years.

17. Defects in material, workmanship, and installation of the tile finish against cracking and delamination for a period of five (5) years.

18. Manufacturer's minimum fifteen (15) year systems warranty against defective materials, components and workmanship in the pool tile setting materials.

19. Defects in material, workmanship and installation of the pool, surge/balance tank and backwash pit waterproofing finish against delamination for a period of one (1) year.

20. Manufacturer's minimum two (2) year warranty against defective materials, components, and workmanship in the pool underwater lights.

21. Geothermal heating System shall have a five (5) year labor, seven (7) year parts warranty. The titanium parts of the condenser and evaporator heat exchangers (coils) in the units have a lifetime parts warranty. The rest of the system has a 1 year all parts and labor warranty.

22. Manufacturer's minimum five (5) year warranty against defective materials, components and workmanship in the pool cover system and reels.

1.12 SYSTEM TRAINING

A. A qualified representative of the CONTRACTOR performing work under this section must put the equipment into operation and instruct the Owner's representatives in the operation of this equipment to the Owner's satisfaction immediately after project's substantial completion.

B. The CONTRACTOR'S training representative must have completed the equipment/system's manufacturer's training requirements and be certified, by the manufacturer, to provide and teach system training.

C. The representative from the CONTRACTOR must be either a CPO (Certified Pool Operator) or have an AFO (Aquatic Facility Operator) certification.

D. Training periods to consist of 32 hours of on-site training and scheduled as follows:

1. Sixteen (16) hours of initial training on the complete swimming pool system. The 16 hours of initial training must be comprised of at least 4 hours of training on water chemistry analysis and adjustment. The water chemistry training will include in depth review of the use of the Langlier index and its computation.

2. The initial eight (8) hours of training must include information on the care, operation, adjustment, and maintenance of items provided by the CONTRACTOR under the "Part 2 – Products" section of this specification.

3. Eight (8) hours of training after the Owner's staff has had experience operating the system. This time may be requested after the pool has been placed in operation within a period of one (1) year from the time the pool was accepted by the Owner. The additional training must contain at least 2 hours of review of water chemistry.

4. Provide a project specific video recording instruction manual in addition to the training sessions. The video instructions must be project specific and must include information on the care, operation, adjustment, and maintenance of items provided by the CONTRACTOR under the "Part 2 – Products" section of this specification. This video recording must be done separate from the Owner training.

5. The CONTRACTOR must include one (1) copy of video recording instructions in each Operations and Maintenance Manual.

1.13 POOL FILL WATER QUALITY

A. The Owner is to bear the cost of the water required for two (2) complete fillings of the pool (the initial water tightness test and the final filling). Removal of iron or copper (if in excess of .3 ppm) will be required for the final fill to avoid staining of the pool finish. Subsequent fillings or partial fillings (more than 25%) of the pool is by the CONTRACTOR, at its own expense.

B. Provide the necessary plant equipment so that the temperature of fill water will be within plus or minus 10 degrees of the ambient air and/or the pool structure at the time of filling. Extreme caution is urged if the temperature variance is greater than 10-degree F.

C. Provide the necessary chemicals and to adjust and balance the water chemistry in the pools to the following levels:

pH	7.4 - 7.6
Calcium Hardness	200 - 400 PPM
Total Alkalinity (Sodium Hypochlorite)	80 - 120 PPM
Langelier saturation index	-0.3 - +0.3
Total Dissolved Solids (TDS)	not to exceed 1,500 PPM

1.14 START-UP CHEMICALS

A. The CONTRACTOR must maintain the chemical balance of the pool water (including the cost of chemicals required) until the pool and mechanical system(s) are fully operational and accepted by the Architect and the Owner.

B. Provide the Owner with sufficient quantities of the necessary chemicals to maintain the pool operation after the owner begins using the pool.

1. Contractor is required to provide chemical quantities as shown on the drawings for the following chemicals:

a. Sodium Hypochlorite

b. Muriatic Acid

2. Contractor is required to provide chemical quantities as shown on the drawings for the following balancing chemicals:

a. Sodium Bicarbonate

b. Calcium Carbonate

c. Sodium Thiosulfate

C. Chemicals must be provided to the Owner must include those required by the chemical feed systems provided.

1.15 RECORD DRAWINGS

A. Provide a complete set of record drawings of the entire pool system(s) including sub-systems. Record drawings must be prepared in accordance with the requirements of Section 01720 or 017839 and must be a complete, stand-alone set. The CONTRACTOR is permitted to obtain original documents and copy them for this purpose only. Provide the record set on compact disk (AutoCAD Release 2010 or compatible software).

PART 2 - PRODUCTS

2.01 OVERFLOW SYSTEM

A. It is the intent of the specifications that the perimeter overflow system and surface cleaning be maintained under conditions of normal operation and that no water be discharged to waste except when cleaning the filters or emptying the pool.

B. Concrete Perimeter Overflow System

1. A perimeter overflow system consisting of a continuous concrete and tile overflow channel must be provided as detailed and shown on the drawings for the pool(s). The bottom of the trough must be level throughout.

2. The complete gutter trough interior must be coated with epoxy paint. Refer to section 2.15. Areas not meeting the manufacturer's recommended thickness will be recoated without additional cost to the Owner.

3. Grating corner installations must be prefabricated thermo-welded corner sections provided by the grating manufacturer and installed with adequate support per manufacturer recommendations. Butting grating sections together at corners is not permitted.

4. For the zero-entry trench, the grating must be formed of molded white PVC sections. Modular, interlocking pieces of UV stabilized PVC grating. The top surface must have a raised, diamond ridge design to create good friction, wet or dry and be 11/16" wide with an outside depth of 1.0" and a middle depth of 1-3/8" for extra strength. The space between pieces must not exceed 3/8". Each piece of grate must have a slotted hole at the ends for insertion of a stainless-steel fastener clip and anchor screws every 5 feet and must be easily removable. Grating must be supplied with a PVC curb angle support for connection to the gutter as shown on the drawings. Curb angle must be supplied by the grating manufacturer. Grating surface bars must run perpendicular to the pool wall and with the gap, provide at least 35% open space per foot for unrestricted water flow. The color of the grate must be selected by the Architect.

   a. Basis of Design: Grating must be manufactured by Lawson Aquatics supplied by Neptune-Benson, Daldorado, DuraTech by Renosys, or approved equal.

5. For the pool gutter grating, the grating must be formed of molded PVC sections. Modular, interlocking pieces of UV stabilized PVC grating. The top surface must have a raised, diamond ridge design to create good friction, wet or dry and be 11/16" wide with an outside depth of 1.0" and a middle depth of 1-3/8" for extra strength. The space between pieces must not exceed 3/8". Each piece of grate must have a slotted hole at the ends for insertion of a stainless-steel fastener clip and anchor screws every 5 feet and must be easily removable. Grating surface bars must run parallel to the pool wall and with the gap, provide at least 35% open space per foot for unrestricted water flow. The color of the grate must be selected by the Architect. The width of the grating must allow the insertion of the touchpad holding brackets between the grating and the gutter lip.

   a. Basis of Design: Grating must be manufactured by Lawson Aquatics supplied by Neptune-Benson, Daldorado, or approved equal.

6. Materials, anchors, and fasteners must be 304L stainless-steel.

2.02 PUMPING EQUIPMENT

A. Proposed substitutions must include a mechanical drawing incorporating required changes in layout, piping, and valves. The cost of such changes must be included in the price of the substitute. Confirm correct pump motor voltage prior to ordering pump. Motors must be capable of continuously running without overloading at points on the characteristic curve of the pump without overload or damage. Confirm by 1/4-inch scale shop drawing that the pumps provided will fit within the available space and can be reasonably removed for servicing.

1. Pumps must be certified by the National Sanitation Foundation (NSF) and bear the certification mark.

2. If the pump is powered with a VFD, the impeller must be trimmed to a maximum diameter based on the most limiting condition of either the diameter of the maximum non-overloading rated motor horsepower at the design point or a diameter resulting in 10% greater head than the specified head.

3. Pump motor must be totally enclosed, fan cooled (TEFC) and premium efficiency of the horsepower and speed specified. A pump requiring larger horsepower is not acceptable unless submitted as a

substitute and approved by the engineer, in which case necessary electrical revisions must coordinated and provided.

4. Entire pumping unit must be mounted on a base using cap screws to preserve the back-pull-out feature of the pump. Pumps must not be secured with floor studs or "all-thread". The pump base must be coated with the same epoxy coating as the pump.

5. Recirculation and Feature Pumps – Metallic Components

   a. Provide horizontally mounted centrifugal pumps as shown on the drawings and described in these specifications. Each pump must be of a straight centrifugal, end suction, bronze fitted, close coupled type.

   b. Pumps manufactured by Paco, Griswold, Aurora or Herborner are considered equal, provided they meet the requirements.

   c. Pump casing must be cast iron fitted with a replaceable bronze case wear ring. Mechanical seals must be provided specific for a chlorinated water application. Pump impeller must be enclosed type of cast bronze or 316L stainless-steel, statically, and dynamically balanced, and trimmed for the specified design conditions. If a VFD must be used in conjunction with a pump, the impeller must be trimmed to the maximum diameter based on the rated motor horsepower. Bronze materials must be suitable for use in a chlorinated environment. Suction and discharge flanges must be provided and tapped for gauge connections. Provide steel or cast-iron bases with equivalent epoxy coating for corrosion protection.

   d. Provide a fusion-bonded epoxy coating on wetted parts to protect pump internals from corrosion, including pump volute interior and complete pump impeller (bronze impellers only). Sandblast to bare, white metal. Thickness must be 8 to 12 mils (heavy film). Verify thickness by non-destructive testing. Coat parts as recommended by manufacturer, including preheating parts to 400 degrees and electrostatic deposition or fluidized bed technique. Provide primers if required to resist chlorinated water <10 ppm. Coating must be Scotchkote 134 manufactured by Fusecote or approved equal.

   e. Provide a hair and lint strainer, for each pump, of fiberglass construction with a clear observation top in the sizes (or pipe sizes) indicated on the drawings. Provide hair and lint strainers with perforations no greater than 1/16" for feature pumps. Verify and coordinate pipe and pump suction sizes in the field. Provide a stainless-steel basket with at least 4 times the free open area as the inlet pipe, and one spare basket with each strainer.

      1) Basis of Design: As manufactured by Fluidtrol Process Technologies, Inc or Neptune/Benson Inc.

   f. Recirculation pumps must be provided by the same manufacturer. Confirm voltages prior to ordering pumps.

6. Other System Pumps and Motors

   a. Provide one (1) portable utility pump(s). The pump(s) must be a 1 HP, 3600 RPM, 115-volt, 1 phase, 60 cycle unit capable of 60 GPM at 25 ft. TDH.

      1) Basis of Design: Pump must be a Godwin GSP10 or approved equal.

B. Variable Frequency Drive Starters

1. Provide variable frequency drive starters (VFD) for the pool pumps. VFDs must be Eco-Flow-C by H2Flow Controls, AcuDrive by Pentair, GreenDrive by Neptune Benson, or approved equal.

   a. Basis of Design: AcuDrive by Pentair

2. Ensure that equipment is provided with the correct operating voltage and that interconnected electrical and electronic equipment must adequately communicate and operate the specified pumping equipment. Equipment installations must meet or exceed the requirements of the National Electric Code and other local and state regulations.

3. Variable Frequency Drive Capabilities

a. Provide complete VFD as specified herein or in the equipment schedule for loads designated that must be variable speed or variable flow.

b. The VFD must convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD must be a six-pulse input design, and the input voltage rectifier must employ a full wave diode bridge. The output waveform must closely approximate a sine wave. The VFD must be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform.

c. Indoor Applications: VFD must be fully enclosed in a corrosion resistant NEMA 12/IP54 UL listed enclosure.

d. VFD and required options will be incorporated by the VFD manufacturer into an integrated package, with a single input feed and main disconnect.

e. VFD must have a fused disconnect and battery back-up, for the purpose of maintaining programming in the event of a power outage.

f. The VFD must produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or derating.

g. The VFD must provide rated RMS fundamental output voltage. The VFD must utilize VVC^{PLUS}, an output voltage-vector switching algorithm, or equivalent, in both variable and constant torque modes. This allows the motor to operate at a lower temperature rise, extending its thermal life.

h. The VFD selected must be able to source the motor's full load nameplate amperage (fundamental RMS) on a continuous basis and be capable of running the motor at its nameplate RPM, voltage, current, and slip without having to utilize the service factor of the motor.

i. The VFD must offer a programmable motor parameter that allows the total number of poles of a motor that must be programmed to optimize motor performance.

j. VFD must automatically boost power factor at lower speeds.

k. The VFD will be capable of running either variable or constant torque loads. In either CT or VT mode, the VFD must be able to provide its full rated output current continuously and 110% of rated current for 60 seconds.

l. An Automatic Energy Optimization (AEO) selection feature must be provided in the VFD to minimize energy consumption in variable torque applications.

m. VFD must offer a motor spinning test that will run the motor at 5 Hz until the OK button is pressed. This feature will allow the user to determine if the motor is running in the correct direction.

n. Switching of the input power to the VFD must be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes.

o. Switching of power on the output side between the VFD and the motor must be possible with no limitation or damage to the VFD and must require no additional interlocks.

p. An Automatic Motor Adaptation (AMA) function must measure motor stator resistance and reactance to optimize performance and efficiency.

q. Cooling must be via an aluminum heat sink and must prevent the introduction of ambient air to the electronics for cooling. With the exception of the water-resistant heat sink fan, electronics must be fully sealed within the enclosure.

r. The VFD must have temperature-controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life.

s. VFD must provide full torque to the motor, given input voltage fluctuations of up to +10% to -10% of the rated input voltage.

4. Harmonics:

a. The VFD must provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor.

b. The VFD must be provided with line-side harmonic reduction, as required, to ensure that the current distortion limits, as defined in table 10.3 of IEEE 519-1992, are met.

c. Harmonic solutions must be designed to withstand up to 2%-line imbalances with the maximum Current Distortion not to exceed 11% at 100% load.

d. Harmonic solutions must be capable of withstanding up to 2% ambient voltage distortion with the maximum Current Distortion not to exceed 12% at 100% load.

5. Protective Features:

a. VFD must have input surge protection utilizing MOV's, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.3 msec.

b. VFD must include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

c. Printed Circuit boards must be conformal coated to reduce the corrosion effect from environmental gases and other conditions. The conformal coating must meet IEC 61721-3-3, Class 3C2 as standard.

d. Automatic "No-Flow Detection" must be available to detect a no-flow situation in pump systems where valves can be closed. This must be functional in closed loop control or when controlled by an external signal.

e. Dry-pump detection must be available to detect if the pump has run dry. If this condition occurs, the drive will be safely stopped. A timer must be included to prevent nuisance tripping.

f. End-of-Pump curve detection must stop motor when the pump is operating outside of its programmed pump curve.

g. VFD must provide a flow compensation program to reduce energy by adjusting the Setpoint to match changes in flow (friction loss).

h. VFD must include current sensors on three-output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

6. Interface Features:

a. VFD must provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.

b. VFD Keypad must feature an INFO key that, when pressed, must display the contents of the programming manual for the parameter that is currently viewed on the display.

c. VFD Display must have the ability to display 5 different parameters pertaining to the VFD or the load including: current, speed, DC bus voltage, output voltage, input signal in mA, or other values from a list of 92 different user-selectable parameters.

d. A red FAULT light, a yellow WARNING light and a green POWER-ON light must be provided. These indications must be visible both on the keypad and on the VFD when the keypad is removed.

e. Two-level password protection must be provided to prevent unauthorized changes to the programming of the VFD.

f. A quick setup menu with factory preset typical parameters must be provided on the VFD to facilitate commissioning.

g. A digital elapsed time meter and kilowatt hour meter must be provided in the display.

h. VFD must offer as standard an internal clock. The internal clock can be used for: Timed Actions, Energy Meter, Trend Analysis, date/time stamps on alarms, Logged data, Preventive maintenance, or other uses.

i. A battery back-up must be provided to maintain internal clock operation during power interruptions.

j. Inputs and outputs must be optically isolated.

k. The VFD must have two analog signal inputs. Inputs must be programmable for either 0 - 10V or 0/4-20 mA.

l. One programmable analog output must be provided for indication of the drive status. This output must be programmable for output speed, voltage, frequency, motor current and output power. The analog output signal must be 0/4-20 mA.

m. The run permissive circuit must be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.

n. The VFD must be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port.

7. Adjustments:

a. The VFD must have an adjustable output switching frequency.

b. Four complete programming parameter setups must be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to program for up to four alternate control scenarios without requiring parameter changes.

c. In each programming setup, independent acceleration and deceleration ramps must be provided. Acceleration and deceleration time must be adjustable over the range from 0 to 3,600 seconds to base speed.

d. The VFD must have four programmable “Bypass frequencies” with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature must offer a Semi-Automatic program to simplify the set-up.

e. VFD must include an automatic acceleration and deceleration ramp-time function to prevent nuisance tripping and simplify start-up.

f. The VFD will include a user-selectable Reset function, which enables the selection of between zero and twenty restart attempts after a self-clearing fault condition (under-voltage, over-voltage, current limit, inverter overload, and motor overload), or the selection of an infinite number of restart attempts. The time between restart attempts must be adjustable from 0 through 600 seconds.

g. An automatic “on-delay” function may be selected from 0 to 120 seconds.

h. The VFD will include a user-selectable Auto-Restart function that enables the VFD to power up in a running condition after a power loss, to prevent the need to manually reset and restart the VFD.

8. Bypass

   a. Provide a manual bypass in conjunction with the VFD for the recirculation pump(s) and feature pump(s) consisting of a door interlocked main fused-disconnect pad lockable in the off position, a built-in motor starter and a four position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at a programmable speed or flow rate from the VFD. In the OFF position, the motor and VFD are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the drive so that service can be performed. In BYPASS Position, a soft starter will be in the circuit to allow the motor to avoid an across the line start. In the TEST position, the motor is operated at full speed from the AC line power. This allows the drive to give an operational test while continuing to run the motor at full speed in bypass.

9. Individual VFD options such as bypass, motor selection contactors, etc. must be incorporated by the manufacturer onto a single panel with single input feed and main disconnect function. Enclosures must be UL listed and fully assembled by the VFD manufacturer.

10. Service Conditions:

   a. The ambient operating temperature of the VFD must be -10ºC to 50ºC (14 to 122°F).

   b. 0 to 95% relative humidity, non-condensing.

   c. Elevation to 3,300 feet (1000 meters) without derating.

   d. VFD's must be rated for line voltage of 525 to 690VAC, 380 to 480VAC, or 200 to 240VAC; with +10% to -10% variations. Line frequency variation of ± 2% is acceptable.

C. Pump Gauges

1. Pressure gauges must be provided on the discharge of the pumps.

2. Compound gauges must be provided at the intake port of the pumps, after the hair and lint strainer.

3. Gauges must be liquid filled, 316L stainless-steel bourdon tube type with a minimum 2-1/2-inch diameter dial, high impact polypropylene or stainless-steel case, corrosion resistant white scale with black divisions and numerals, 300 Series stainless-steel heavy duty rotary bushed movement, black enameled balanced Micrometer pointer.

   a. Basis of Design: Gauges must be as manufactured by Weksler Instrument Corporation or approved equal.

4. Scale ranges must be selected to indicate the normal system operating pressure of each system or location within the system. Pressure ranges must be calibrated in psig (0-60 psi) and compound gauge must be calibrated in inches of mercury (0-30 in Hg / 0-60 psi).

5. A stainless-steel filter type pressure snubber must be provided for each pressure gauge consisting of a 3/8-inch diameter by 1/8-inch-thick micro metallic stainless-steel filter and placed in the line just before the pressure gauge. Provide isolation brass valves or brass gauge cocks at each gauge for easy replacement and maintenance.

2.03 FILTRATION EQUIPMENT

A. The filter system must consist of high-rate pressure sand filter tanks as shown on the drawings. Every aspect and component of the filter system must be certified by the National Sanitation Foundation (NSF) and bear the certification mark. The filter must have an engraved metal data plate permanently affixed on the face of the system that describes operational data and instructions and indicates startup date.

B. It is the intent of these specifications to describe a filtration system complete in every respect with accessory items and supplied and warranted by one manufacturer.

C. Horizontally Oriented Fiberglass Tanks

1. The filter tanks must be horizontally oriented single cell fiberglass tanks, minimum 42 inches in diameter. The filter system must be listed as approved by National Sanitation Foundation prior to bid date.

    a. Basis of Design: Fiberglass filters must be the product of Stark/Pentair, Fluidtrol, or Neptune Benson provided they meet the specifications and layout. System design based upon Neptune-Benson. Valves must be provided to backwash one filter at a time.

2. Filter tanks must incorporate components and feature as described in this section.

3. Two (2) saddle style bases must be provided for tank support. Systems that incorporate stacked tanks must include similar bases and mounting saddles for the upper vessel. Tank supports and connections must be seismic rated to support the filter tank(s) for the appropriate seismic zone where the project is located. Access to the tank must be provided by a 14" x 18" manhole with two (2) curved yokes. Manhole seal must be complete with a one-piece 1/4" neoprene gasket and positioned so that internal pressure from the filter will augment the seal. No additional hardware or through bolts will be allowed.

4. Each filter tank must be equipped with the necessary flanges and connections for the internal and external piping. Connections must be comprised of fiberglass flanges and schedule 80 PVC flanges.

5. Tank connections 2 inches and smaller must be 150 lb. Type 316L stainless-steel threaded full couplings. Tank connections 3 inches and larger must be heavy steel bosses drilled and tapped both sides to receive standard flanged fittings or Sch. 40 Type 316L stainless-steel nipples.

6. The discharge from the automatic air release valve must be hard piped to waste. Each filter tank must have a means of releasing air. Each coupling or orifice must be provided with a slotted PVC sand retainer or stainless-steel strainer. An automatic air release system must be provided for each tank.

7. The drain system must consist of a 3/4-inch 316L stainless-steel coupling mounted at the lowest point in the bottom head. This drain must be valved and piped to the nearest floor drain or backwash pit.

8. Filter Piping - Internal

    a. The lower internal distribution system must be a horizontal header/lateral arrangement. The header must be Schedule 80 PVC construction, capped on one end and flanged or threaded at the other end for field connection. Lateral connections must be spaced no more than 6 inches on centers and must be 1-1/2-inch FPT connections. Attachments to header must be solvent welded and thermo-welded to ensure integrity of connection.

    b. Under drain system must be factory installed and constructed of extra heavy Schedule 80 high impact PVC. Multiple PVC main headers must be tapped and threaded to receive laterals.

    c. Laterals must consist of 1-1/2-inch Schedule 80 PVC pipe with openings as required. Each lateral must be fabricated complete with socket cap on one end and male adapter on the other end. Both fittings must be solvent welded to the slotted pipe. Laterals must be designed and sized at the factory, so they are installed in the field and over the entire cross sections area of the filter.

    d. The upper distributor must consist of PVC piping Schedule 80 and/or deflector plate per manufacturer standard design.

    e. Each filter must be supplied with a pressure equalizing upper internal distribution system consisting of a horizontal header/lateral arrangement. The header piping must be constructed of Schedule 80 PVC. The header/lateral piping and connections must be designed and sized to provide uniform distribution and unrestricted flow during the filtration and backwash cycles.

f. Upper laterals must be constructed of Schedule 80 PVC pipe with machine slotted openings or orifices. Machined slots or orifices must be clean, de-burred and free of obstructions that would not permit the free flow of water through the opening. Details of the lateral attachment to the header must be submitted for review and approval.

g. The lower and upper distribution systems must be properly supported and anchored. Hardware in wetted areas must be Type 316L stainless-steel or non-metallic. Tank interiors must be inspected prior to the media being placed in the filters.

9. Filter Piping - External (Face)

a. External face piping must be Schedule 80 PVC pipe and fittings. Flanges must be located so as to allow for easy dismantling of face piping. Fittings must be solvent cemented.

b. Piping must be drilled and tapped where necessary to accommodate gauge tubing connectors.

c. Valves 3" and larger must be constructed with cast aluminum S12A alloy (as defined by ASTM B275) housing and fully coated with Rilsan on interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated ductile iron disc and 316L stainless-steel shaft. Valves must be rated for 150 psi bubble tight shutoff. Unless otherwise specified, nuts and bolts must be stainless-steel with stainless-steel washers and used when secured to PVC flanges. Systems incorporating solenoid, pneumatic, pressure amplified, hydraulic or multi-directional valves are not acceptable.

d. Standard accessory items must include sight glass rated for 50 psi with polycarbonate glass, remote mounted gauge panel with two 4½" diameter pressure gauges, ¼" petcocks, ¼" poly vent tubing with PVC compression adapters.

10. Backwash Control

a. The filter manifold face piping must be designed to allow for one (1) filter tank to backwash at a time while the recirculation system is operating. A manual backwashing system must be provided with the filter system.

b. Manual Backwash System

1) The manual backwash system must be equipped with a face piping configuration such that the operator must be manually control and operator both the time and sequencing of the backwash cycle. Valving on the filter face piping must be a mechanical linkage device allowing the operator to simultaneously move two (2) valves at once. Mechanical linkage components must be PVC or Type 316L Stainless-steel.

11. Automatic Air Relief Valve

a. A 1" valve must be provided to automatically and continuously release air in the filter. The valve must be fabricated of plastic with Buna-N seals. A plumbing kit must be provided with two (2) PVC ball valves to allow manual air relief and isolation of the automatic valve. Valves fabricated of cast iron, bronze or stainless-steel valves will not be accepted.

12. Filter Media

a. Filter media must be a carefully selected grade of hard uniformly graded silica material. Media must be milled angular shaped particles of silica quartz. The filter sand must have a particle size between 0.45 mm and 0.55 mm and have a uniformity coefficient not to exceed 1.53. Specific gravity must not be less than 2.5 with a pH of 7.0.

b. Media (sand) must be cleaned and free from clay or limestone deposits. Bottom layer of support media must be placed by hand to avoid damage to the under-drain system and leveled before the addition of the upper layer of filter media.

c. Media must be delivered after approval by the manufacturer of the filter and stored in 100-pound bags for ease of handling and elimination of possible contamination.

d. Media must be supplied by the filter manufacturer and approved by the filter manufacturer prior to shipping.

13. Support Media

a. A Gravel support media of a hard-coarse aggregate with a sub-angular grain shape with a particle size of 1/8" x 1/4" must be used on the inside of the bottom head to the elevation where the filter media commences. The specific gravity must not be less than 2.5. Support media must be placed by hand to avoid damage to the under-drain system and leveled before the addition of the upper layer of filter media. Concrete under fill is not recommended. Support gravel must be delivered and stored in 100-pound bags (approximately one cubic foot) for ease of handling and elimination of possible contamination. Media must be free from minerals which can precipitate onto pool surfaces.

b. Sand must be a carefully selected grade of hard, uniformly graded silica material. Media must be naturally rounded particles of silica or milled angularly shaped particles of silica quartz. Sand must have a particle size between 0.45mm and 0.55 mm (#20). No more than 1.5% is allowed to pass through a #40 sieve (.0164"). Uniformity coefficient must not exceed 1.53. Specific gravity must be not less than 2.5. Filter must contain a minimum bed depth as recommended by the manufacturer. Systems which do not provide a minimum bed depth will not be accepted. Sand must be delivered and stored in 100-pound bags (approximately one cubic foot) for ease of handling and elimination of possible contamination. Media must be free from minerals which can precipitate onto pool surfaces.

2.04 RECIRCULATION FITTINGS

A. Main drains must be Fiberglass box with PVC grating as sized on the drawings. Grate openings must not exceed 11/32 inch in width, providing an open flow area to allow water velocity not to exceed 1.5 fps. The grate must be PVC or stainless steel and fit closely and flush with top surface of frame and secured to frame with vandal proof fasteners. . Exposed edges of main outlets must be rounded and smooth, free of burrs and sharp edges. Main drain covers must comply with the Virginia Graeme Baker Act and ANSI/APSP-16 2017.

B. Provide hydrostatic relief valves consisting of a 2" cycolac relief valve connected to an FPT commercial style Schedule 80 PVC collector tube. The collection tube must have seepage holes, 3/8 inch in diameter, and must be screwed securely to the valve body. The hydrostatic relief valve must be designed to seal with minimum pressure and must have a non-plugging, self-cleaning raised valve seat. Hydrostatic relief valve must be Hayward model #SP1056 with collector tube model #SP1055, Aquastar model #HVC101 or approved equal.

C. Wall inlet fittings must be cycolac directional inlet Hayward model #SP-1421-D (3/4" opening) mounted in model #SP-1022S, Aquastar model #3301 (1" opening), Aquastar model #3301B (3/4" opening) or approved equal from Sta-Rite.

D. Adjustable floor inlet fittings must be provided each consisting of an ABS plastic body and adjusting top plate with a positive locking device. A spanner wrench must be provided to facilitate flow adjustment. The inlet body must be provided with a 2-inch cycolac solvent weld connection and internal NPT threads to facilitate line pressure testing. Floor inlet fittings must be Sta-Rite model #8417-0000-white and 8417-0200-black, Aquastar model #4DIV101(white) and #4DIV102(black) or approved equal.

E. Sight sump frame and cover must be 12" x 12" PC style quazite polymer concrete enclosure model #PC1212BA12 with cover model #PC1212CA00. Cover must be provided with stainless-steel vandal-resistant fasteners. Cover color selected by Architect. Standard color is concrete grey.

F. Anti-vortex plates must be provided at the suction points of the main recirculation pump(s) in the surge tank(s). Each plate must be connected to the suction pipe via a PVC flange and must be ½ in. thick with minimum dimension of at least 2.5 times the connecting pipe diameter. The plate must be located 4 inches above the finished floor of the surge tank. Four (4) 3/4 in. stainless-steel threaded rods, nuts, anchor bolts and washers

must be used to fix the offset distance and provide a secure base for the suction pipe. Manufactured fiberglass or PVC anti-vortex plates by Daldorado, Neptune-Benson or approved equal.

2.05 PIPING SYSTEMS

A. General

1. Provide recirculating piping between the pool(s) and the filter room, fill receptor and interconnecting piping to and from the chemical feed systems and chemical controller.
2. Provide necessary pipe supports and support systems required to support associated piping and valves.
3. Provide other tubing, conduit, or piping associated with equipment specified herein. Coordinate with other trades.

B. Pipes

1. Pipe routing as shown and detailed on the contract drawings is diagrammatic only and is not intended to show minor details or exact locations of piping systems. Installation is required and must be adjusted to accommodate interference and adjustments anticipated and encountered. Pipe sizes on plans refer to nominal inside diameter of the pipe.
2. PVC swimming pool piping must be NSF approved and conform to the requirements of ASTM D-1785.
3. PVC pipes must be the product of one manufacturer. Approved manufacturers of PVC piping are Eslon, Harvel, and Chemtrol or approved equal.
4. Swimming pool piping above the floor or deck in the filter room must be Schedule 80 PVC.
5. Swimming pool piping below the filter room floor or deck must be NSF approved, Schedule 80 PVC.
6. Swimming pool piping under the pool floor must be NSF approved, Schedule 40 PVC and concrete encased. Transitions between Schedule 40 and Schedule 80 must be encased in concrete.
7. Below grade swimming pool piping not located beneath the pool floor can be backfilled with native granular material free of ice, clay, debris, organic matter, and rocks larger than 4" across their greatest dimension, and per recommendations indicated in the project geotechnical report.
8. PVC and CPVC fittings must be the product of one manufacturer. Molded fittings must be as manufactured by Asahi, Eslon, Chemtrol, Harvel, Spear, Lasco or acceptable substitute. Fabricated fittings must be as manufactured by Harrison Machine, Plastinetics, or acceptable substitute.
9. Vertical sight sump piping must be NSF approved, Schedule 40 PVC. Horizontal sight sump piping must be NSF approved, Schedule 40 PVC that is perforated and wrapped with fabric and have 3/8” diameter holes located top and bottom on 4 ft centers. Horizontal sight sump piping must extend 1 ft minimum beyond the main drain.
10. Chemical feed lines from chemical feeders to recirculation piping must be Schedule 80 PVC piping. Piping must be hard piped into the recirculation piping via tee or saddle per the drawings. Required valves must be of PVC construction.
11. Splash collar(s) for the fill funnel(s) must be clear Schedule 80 PVC and manufactured from a Type I, Grade I PVC compound with a Cell Classification of 12454 per ASTM D1784. The pipe must be manufactured in compliance to ASTM D1785.
12. Y-strainers for piping sized 4” or smaller must be Hayward YS Series strainers with FPM O-rings or approved equal. Y-Strainers for piping sized 6” or larger must be Fluidtrol WYE Series strainers with EPDM gaskets or approved equal. Provide an extra perforated screen with each strainer.
13. Flanged plumbing connection hardware must be stainless-steel.

14. Materials must be installed by workmen thoroughly skilled in their trades and work must present a neat and mechanical appearance when complete. At no additional expense to the Owner, replace or correct work not judged acceptable by the Architect, Owner's testing agency, or their consultants.

15. Support hardware, brackets, fasteners, hangers, etc. furnished and installed in the surge tank must be 316L stainless-steel.

16. No installation allowed that will provide a cross-connection or interconnection between a distributing supply for drinking purposes and the swimming pool, or between the pool and a sanitary or storm water sewer system that will permit a backflow of water into the pool water system.

17. Piping must be hydrostatically (water) pressure tested for leaks before and after backfilling to guarantee water tightness. Pneumatic (air) pressure test not allowed.

18. Provide water seals for watertight penetrations of concrete walls and floor slabs.

    a. Pool Concrete: Water seals must be coupling or sleeve type with a thermo welded or molded flange and the O.D. must be sized to 150% of the O.D. of the pipe. The thermo-welded type must be welded from both sides. Water seals must be located at the centerline of the wall or slab being penetrated prior to placing the concrete to assure a watertight seal. Manufactured fiberglass and PVC water seal fittings by Daldorado, A.S.A. Manufacturing, Aqaulogic or approved equal.

    b. Pump Pit: Link seals must be provided in the sizes and quantities shown on the drawings and installed to provide a flexible watertight penetration. Metal parts must be made of 316L stainless-steel. Links must form a continuous rubber seal that is tightened with a series of stainless-steel bolts to form a watertight seal. Link seals must be manufactured by GPT, Calpico Inc. or approved equal. Xypex Patch'n Plug or approved equal must be used to seal pipe penetration. Link seals must be installed with either a cored hole or a Century Line pipe sleeve.

    c. Surge Tank: Water seals must be coupling type with a thermo welded or molded flange and the O.D. must be sized to 150% of the O.D. of the pipe. The thermo-welded type must be welded from both sides. Water seals must be located at the centerline of the wall or slab being penetrated prior to placing the concrete to assure a watertight seal. Manufactured fiberglass and PVC water seal fittings by Daldorado, A.S.A. Manufacturing, Aqualogic or approved equal. Link seals are also acceptable with a cored hole or a Century Line pipe sleeve.

19. Adhere to the applicable provisions in Division 22 - /Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.

20. Mechanical equipment must be connected into the recirculation piping system must be connected utilizing flanged or union connections.

21. Provisions must be made to purge pipes in the system.

22. Concentric reducers must be fiberglass by MerMade Filter, Inc., or equivalent reducers of schedule 80 PVC construction.

C. Pipe Hangers and Supports

1. Manufacturer

    a. Subject to compliance with these specifications, pipe hanger and support systems must be manufactured by Cooper B-line (basis of design), Inc, TOLCO, and Anvil International or approved equal.

2. Hangers

    a. Pipes 2 inches and smaller

        1) Adjustable steel clevis hanger, B-Line models B3100 or B3104.

        2) Adjustable steel swivel ring (band type) hanger, B-Line model B3170.

b. Pipes 2-1/2 inches and larger

1) Adjustable steel clevis hanger, B-Line model B3100.

2) Adjustable steel yoke pipe roll, B-Line model B3114.

3. Multiple or Trapeze Hangers

a. Trapeze hangers must be constructed from 12-gauge roll formed ASTM A1011 SS, Grade 33 structural steel channel, 1-5/8 by 1-5/8-inch minimum, B-Line B22 strut or stronger as required.

b. Mount pipes to trapeze with 2-piece pipe straps sized for outside diameter of pipe, B-Line B-2000 series.

4. Wall Supports

a. Pipes 2-1/2 inches and smaller

1) Steel offset "J" hook hanger, B-Line model B3600.

b. Pipes 3 inches and larger

1) Welded strut bracket and pipe straps, B-Line models B3064 and B2000 series.

2) Welded steel bracket B-Line model B3066 or B3067 with roller chair or adjustable steel yoke pipe roll. B-Line model B3120 or B3110.

5. Floor Supports

a. Electroplated carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. B-Line model B3092 and B3088T or B3090 and B8088. Pipe saddle must be screwed or welded to appropriate base stand.

6. Vertical Supports

a. Steel riser clamp sized to outside diameter of pipe, B-Line model B3373.

7. Plastic Pipe Supports

a. V-Bottom clevis hangers with galvanized 18-gauge continuous support channel, B-Line models B3106 and B3106V, to form a continuous support system for plastic pipes smaller than 1 inch or flexible tubing.

b. A vented and sloped continuous PVC Schedule 40 pipe no smaller than 1-1/2 inch outside diameter will be used to route flexible tubing with the appropriate pipe supports.

8. Supplementary Structural Supports - Design and fabricate supports using structural quality steel bolted framing materials. Channels must be roll formed, 12-gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch or greater as required by loading conditions. Submit design for pipe tunnels, pipe galleries etc. for approval. Use clamps and fittings designed for use with the strut system.

D. Hanger Attachments

1. Upper Attachments

a. Beam Clamps

1) Beam clamps must be used where piping must be suspended from building steel. Clamp type must be selected on the basis of load supported and load configuration.

2) C-Clamps must be locknuts and cup point set screws similar to B-Line model B351L or B3036L. Top flange c-clamps must be used when attaching a hanger rod to the flange of structural steel, B-Line model B3034 or B3033 or approved equal. Refer to manufacturer's recommendations for set screw torque. Retaining straps must be used to maintain the clamp position on the beam where required.

3) Center load beam clamps must be used where specified. Steel clamps must be B-Line models B3050 or B3055. Forged steel beam clamps with cross bolt must be B-Line B3291-B3297 series or approved equal as required to fit beams.

b. Concrete Inserts

1) Cast in place spot concrete inserts must be used applicable, either steel or malleable iron body, B-line B2500 or B3014 or approved equal. Spot inserts must allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rods sizes, B-line models N2500 or B3014N series.

2) Continuous concrete inserts must be used where applicable. Channels must be 12 gauge, ASTM A1011 Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert must have a load rating of 2,000 lbs/ft. in concrete, B-Line models B22I, 32I, or 52I or approved equal. Select channel nuts suitable for strut and rod sizes.

E. Hanger Accessories

1. Hanger rods must be threaded on both ends or continuously threaded rods of circular cross section. Use adjustable lock nuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

F. Hanger Finish

1. Indoor Finishes

a. Hangers must be zinc plated in accordance with ASTM B633 or must have an electro-deposited green epoxy finish.

b. Strut channels must be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 or must have an electro-deposited green epoxy finish.

c. Zinc Plated hardware is not acceptable for use in chemical rooms.

G. Valves

1. Valves 3 inches and larger must be butterfly type valves, with PVC body, 150# SWP with stainless-steel shaft, PVC or polypropylene disc and replaceable resilient seat bonded to a rigid shaft and guaranteed for bubble tight shutoff from 27-inch vacuum to 150 PSI. Extended neck 2 inch beyond flanges for insulated piping must be provided with handle for manual operation. Valve components must be suitable for swimming pool chlorinated water service. Butterfly valves must be Georg Fischer Type 563, Asahi/America Type SP Pool-Pro, Chemtrol Model-B, Simtech VP series, Colonial Valve 411 Series, or approved equal.

2. Valves smaller than 3 inches must be PVC true union ball valves, full port, three-piece construction, blowout-proof stem, Viton seal with socket end connectors.

3. Check valves must be a quick closing non-slam type, either self-aligning wafer or flanged type, of corrosion resistant materials suitable for use in a swimming pool environment. Provide check valves in accordance with the manufacturer's recommendations. Locate check valves at least 5 pipe diameters from pumps and fittings. Check valves must be Technocheck Corp., model 5050, with epoxy coated cast iron body and bronze swing plates on a stainless-steel spring, Colonial Valve model 601N or 601NP PVC valve with EPDM O-ring and stainless-steel spring or approved equal, for installation between 150 lb. flanges.

4. Modulating float valve in the surge tank(s) must have PVC body and stainless-steel wafer disc. Hardware must be non-corrodible. The float-operated valves must be provided horizontally on the main drain lines in the surge tank(s). Valve must consist of non-corrosion components including shaft, float arm, pins, and floats. Valve must be suitable for mounting on a 125E class standard PVC flange. The float arm leverage weight and pivot lengths must be adjustable to obtain desired ratio of surge tank level change to pool gutter overflow level change. Two floats and stabilizer required. Valve must

be model FV-D XWB (Extra Weight Ball) as manufactured by MerMade Filter, Inc. or approved equal manufactured by Neptune-Benson, EPD, or Fluidtrol Process Technologies, Inc.

5. Submerged valves up to 3 inches must be PVC true union ball valves. Submerged valves over 3 inches must be PVC bodied, wafer type, butterfly valves with stainless-steel handle extensions as required. Valves must be by approved manufacturers listed above. Submerged valves must be provided with stainless-steel connectors. The stem housing extensions must be properly supported and braced.

6. Butterfly type valves 8 inches and larger must be fitted with a watertight gear operator.

7. Valves located 7 feet or greater off the floor must be fitted with a chain operator.

8. Submerged valves, valves buried below grade, or valves not readily accessible, must be provided with a stainless-steel reach rod and handle.

9. Valve hardware must be 316L stainless-steel and meet ANSI hardware installation guidelines.

H. Pipe and valve identification

1. Exposed pool piping must be equipped with color coded flow directional arrows at thirty (30) inch intervals per local and state swimming pool health code. Verify that pool piping identification is in accordance with local and state health regulations.

2. Valves must be identified with minimum 1-1/2-inch diameter brass tags stamped with minimum 1/2-inch-high numbers and attached to valves with #16 brass jack chain. (Plastic laminate engraved tags with nylon attachment acceptable.) Valves must be described as to their function and referenced in the operating instruction manual and wall mounted piping diagram that must be prepared.

2.06 CHEMICAL TREATMENT SYSTEMS

A. Sodium Hypochlorite (Liquid Chlorine)

1. Chemical feeders for chlorine must be peristaltic type pumps. Chemical feed pump(s) must be provided and connected to the filtered water return lines to the pool(s) as shown on the pool plans. The pump(s) must be capable of feeding a solution to the pool(s) to maintain chlorine (12% sodium hypochlorite) level against the back pressure involved and must be fully adjustable while in operation.

2. Chemical feeders must be manufactured by LMI, ProMinent, G. H. Stenner & Co., or approved equal.

3. The pump(s) must be provided complete with fractional horsepower motor for 120V 60 Hz current, plastic feed lines, and fitting necessary for connections to the pool system piping.

4. Chemical pumps must be electrically connected to and operated by the water chemistry controllers.

5. The chemical pump(s) must be affixed with a metallic stamped label indicating the chemical being pumped and the pool to which it is connected.

6. Wall mount or provide non-metallic shelf support for the chemical feed pump(s).

7. Feeder systems must be provided with an injection check valve at point of tap in and strainers with foot valves for suction from 55-gallon drums, carboys, or bulk tank. Bulk tank feed must be from the top.

8. Bulk Chlorine Tank

a. Provide one (1) 500 /bulk chlorine solution tank in the chlorine room as shown on the drawings. Tank must be a double wall bulk tank constructed of polyethylene rigid support with top manway and vent. Tank must be 59” diameter by 71” (high. Manufacturer must be Chemtainer, Industries, TC5971DC (500 gallon) or approved equal.

B. pH Buffering System (Muriatic Acid)

1. Chemical feeders for muriatic acid must be /peristaltic type pumps. Chemical feed pump(s) must be provided and connected to the filtered water return lines to the pool(s) as shown on the pool plans. The pump(s) must be capable of feeding a solution to the pool(s) to maintain pH level against the back pressure involved and must be fully adjustable while in operation.

2. Chemical feeders must be manufactured by ProMinent, G. H. Stenner & Co., or approved equal.

3. The pump(s) must be provided complete with fractional horsepower motor for 120V 60 Hz current, plastic feed lines, and fitting necessary for connections to pool system piping.

4. The chemical pump(s) must be electrically connected to and operated by the water chemistry controllers.

5. The acid pump(s) must be affixed with a metallic stamped label indicating the chemical being pumped and the pool to which it is connected.

6. Provide non-metallic wall mounted shelf support for the chemical feeder(s).

7. Provide four (4) fifteen (15) gallon acid drums.

8. Provide one (1) two drum modular spill platform. Platform must be molded high-density polyethylene with removable polyethylene grating. Platform must be 26.25" x 51.5" x 6.5" with a spill capacity of 30 gallons and a load capacity of 5,000 pounds. Platform must be an Eagle two drum modular spill platform model #1632 or approved equal.

9. Provide one (1) low profile ramp. Ramp must be molded high-density polyethylene. Ramp must be an Eagle low profile ramp model #1689 or approved equal.

10. Provide "Vapor Shield" vent check valve for the acid drum/tank which seals container while allowing the liquid to remove via pump. The Vapor-Shield must prevent an internal vacuum and collapse of a sealed container. It will also prevent the pump from developing a vacuum-lock while attempting to remove the liquid from the sealed container. The Vapor-Shield must prevent the release of acid vapors. The Vapor-Shield body must be constructed entirely from schedule 80 PVC with polypropylene tube fittings and factory-installed acid resistant viton sealant on threaded connections. The diaphragm and O-rings must be constructed of acid resistant viton. No metallic or materials not rated appropriate for use with acid must be used. The Vapor-Shield must be fitted with a ¾" male NPT threaded fitting to allow for the installation onto common five (5) through fifty-two (52) gallon acid shipping container caps and lids. The unit must be supplied with no less than fifteen (15) feet of 3/8" polyethylene tubing. Recreonics #52-095. An Acid Fume Scrubber, part #7747090, with refill reagent kit, #7747091, manufactured by ProMinent is an equal.

2.07 WATER CHEMISTRY MONITORING AND CONTROL SYSTEMS

A. A programmable pool chemical automation system must be provided for continuous monitoring and control of the pool(s) water chemistry and related disinfection equipment. Installation of the system must be per the manufacturer's specification. A factory trained/authorized representative must provide training to the Owner and the training must be video recorded per 131100, Section 1.12 of the project contract documents. Water chemistry controllers must be provided by ProMinent Fluid Controls, BECS Technology, SB Control Systems, or a technically equal system capable of providing equal performance for operating functions.

B. The water chemistry control systems for the pool(s) must feature and be capable of the following. Water chemistry controllers without these capabilities and features are not considered equal. Water chemistry control system requirements are based upon the following products: ProMinent DCM513, BECSys5, Chemtrol 3000.

1. Continuous, real-time monitoring and control of pH and ORP.

2. The controller must be capable of interfacing with an alkalinity meter, which provides a reading of the total alkalinity of the body of water being controlled.

   a. The alkalinity meter must provide monitoring of pool water total alkalinity by performing a flowing water titration, utilizing a single reagent. The alkalinity meter must report the total

alkalinity reading to the water chemistry controller for display, data logging, remote access, alarm notifications and alkalinity control. Installation of the system must be per the manufacturer's specification with no exceptions allowed. A factory trained/authorized representative must provide training to the owner. The specified meter is a BECSys Alkalinity Meter manufactured by BECS Technology, Inc.

b. The water chemistry controller must interface to the alkalinity meter via low-voltage, digital RS485 connection. Parameter changes made via the water chemistry controller user interface must be transmitted by the water chemistry controller to the alkalinity meter. The controller must provide user-programmable settings for low alkalinity and high alkalinity, which will activate a corresponding alarm when the total alkalinity reading exceeds these settings. The controller must monitor, display, and data log total alkalinity to 1 ppm resolution.

c. The alkalinity reagent must be specifically formulated to include no more than 3% hydrochloric acid. Alkalinity reagent must be available from the alkalinity meter manufacturer via the same distribution channel as the alkalinity meter.

d. The alkalinity meter must utilize a dedicated pH sensor with the following characteristics:

1) 0-14 sensing range.

2) ABS body with ½" NPT process connection.

3) Minimum of 32 milliliters of inorganic electrolyte gel; organic electrolytes, susceptible to breakdown in the presence of strong oxidants, are not considered equal.

4) A porous Teflon liquid junction to provide a stable, low impedance reference contact, and to prevent fouling and clogging of the liquid junction.

5) A silver/silver chloride (Ag/AgCl) reference element.

6) A general-purpose glass membrane pH sensing element.

7) Operating temperature range of 0 - 80 degrees C.

8) Operating pressure range of 0 - 100 psig.

3. Free chlorine in PPM, system flow rate, water chemistry balance calculations, water temperature, and other readings and control as deemed necessary for the project per this section.

4. Controller must have the ability to call for pH from both CO_2 and Muriatic acid systems on a user programmable time-of-day schedule to alternate between feeding CO_2 or acid.

5. The controller must manage the recirculation pump with a programmable Fireman Cycle feature, which automatically turns off the Heater, UV, and Auxiliary systems prior to shutting off the recirculation pump.

6. Management of the recirculation pump on/off status.

7. Management of the heater on/off status based on real-time water temperature reading.

8. Management of the water level in the pool or surge tank and must provide programming to lock out chemical feed during potable water fill events.

9. The utilization of simultaneous ORP and PPM (bracketing) control for managing both the quantity and quality of the sanitizer/oxidizer. Controllers that do not have the ability to control simultaneously to ORP and PPM control points or that utilize an alternate chlorine set point or boost function will not be considered an equal.

10. Actuating outputs in the following operator selectable modes: off, manual, automatic, proportional and must have a manual on fail-safe timer to ensure that if the controller is left in manual mode, the controller will revert back to automatic mode to prevent an over-feed event.

11. Programmable events can be time set to occur daily, weekly, or monthly.

12. Remote monitoring of the recirculation flow rate of the system when installed with compatible magmeters.

13. Provide use of flow signal as a supplemental chemical feed interlock to prevent the dosing of chemicals during a system low flow/no flow condition.

14. Controller must continuously monitor, data-log while being monitored and control via two-way remote communication.

15. Controller must continuously calculate and display the Langelier Saturation Index and Ryznar Index using either sensor data and/or manual input for pH, temperature, total alkalinity, and calcium hardness.

16. Programmable high and low alarm levels for control functions with operator-selectable feed lockout and alarm buzzer options.

C. Performance and Certifications

1. The controller system must be NSF/ANSI 50 listed for automatic controller equipment for swimming pools, spas, and other recreational water facilities.

2. The controller system must be certified to UL61010/IEC61010 standards.

3. The controller must automatically activate the appropriate chemical feeders in order to maintain the sanitizer/oxidizer level:

   a. Within +/- 0.1 parts per million (PPM) or +/- 10 mV (millivolts) of oxidation reduction potential (ORP)

   b. The pH within +/- 0.1 pH unit of the set points selected by the operator.

   c. Set point and calibration levels must be adjustable with a keypad mounted on the front panel of the unit as well as the remote interface.

   d. The controller must use pH sensor with +/- 0.04 accuracy in the operational range of 6.8 – 8.2 as certified by NSF.

   e. An ORP sensor with an accuracy of +/- 3% mV as certified by NSF.

   f. A free chlorine sensor that operates in a range of 0.1 parts per million (PPM) up to 10.0 parts per million (PPM) within a 9% accuracy as tested by NSF or another third-party certifying agency.

D. System Supply

1. The controller must be factory supplied with:

   a. ORP, pH, temperature, and free chlorine sensors.

   b. [

   c. A flowrate sensor to measure system flowrate.

E. Hardware

1. The controller must have:

   a. A minimum of seven (7) fully configurable digital inputs.

   b. A minimum of four (4) fully assignable digital outputs.

   c. A minimum of nine (9) configurable analog inputs.

   d. A minimum of five (5), 115 VAC fully assignable relays.

   e. The controller must be capable of expanded capabilities with an optional input/output expansion card kit.

f. High voltage field wiring must be through a separate NEMA 4X factory engineered and supplied enclosure that precludes direct access to controller electronics. High voltage connections must be clearly identified, and a field wiring diagram must be provided with the controller for installer reference. Controller high-voltage relay assignment parameters must be programmed at the factory prior to delivery to installation location.

g. The controller must include a sensing flow cell that is hydraulically designed to allow verified correct flow and consistent pressure across sensors. Flow cell will be clear PVC that is modular in concept and have the flexibility to add supplementary water chemistry sensors as desired. The sensing flow cell must include a safety flow switch sensor, water spigot, and isolation valves.

F. Communications

1. The controller must have as a standard feature:

a. Controller must include the capability of ethernet connection and secondary wireless communication.

b. The controller must allow full two-way remote communication and full control of parameters.

c. Accessibility with a standard internet browser using a fully interactive Ethernet TCP/IP graphical interface that includes security access codes.

d. Real-time monitor/control with real-time auto polling, data logging, email and text alarms and providing both graphical and report formats via a personal computer, smartphone, or tablet device.

e. Controller must have the ability to facilitate email or text alarm notifications, historical graphing, and real-time control via a personal computer, smartphone, or tablet device.

f. Controller must have the ability to export a .csv file once per day with reading type, time, and reading. The export must be done via email and must include the controller serial number. Export data must include ORP, Free Available Chlorine, pH, and Temperature.

g. The controller must have the ability to allow software upgrades and programming as needed in the field.

G. Commissioning and Manuals

1. The control system must be provided with on-site start-up operator training performed by a representative trained and authorized by the controller manufacturer.

2. Manufacturer must supply an operation and maintenance manual describing features, operating instructions, maintenance procedures and replacement parts.

3. Installation of the system must be per the manufacturer's specification and no exceptions must be allowed. A factory trained/authorized representative must provide training to the owner and the training must be video recorded per 131100, paragraph 1.12 of the project contract documents.

2.08 FLOW METERS

A. Flow Meter

1. Flow meters (2 required) must be provided according to the manufacturer in the filtered water return lines to each of the pools. Flow sensor must be the GF Signet 2551 insertion magmeter. Provide the coaxial cable from the sensor to the display/transmitter. Flow meter accuracy must be +/- 2% of reading. The flow instrument must have an LCD for simultaneous display of four-digit flow rate and eight-digit totalizer. Display/Transmitter capability will be part of chemical controller function or as separate Signet GF Signet 9900 display/transmitter. Signet GF Signet 9900 display/transmitter must be powered by 24VDC and provide a 4-20mA output. [

2. Backwash piping flow meter (2 required) must be a pilot, impact ball, variable area type with one piece, impact resistant machined acrylic plastic body. GPM scale must be permanently etched or imprinted on the meter. Flow rate indicator must be of stainless-steel material. Scale range must be appropriate for specific flow rate. Pipe size to accommodate backwash rate. Backwash piping flow meter must be BLUE-WHITE series F-300 or approved equal.

2.09 WATER LEVEL CONTROLLERS

A. In Surge Tank Water Level Controller

1. Provide a water level sensing and control system for the pool(s) that will monitor the water level in the surge tank and automatically activate the auto water make-up control valve. For sensing water level and activating make-up water control valve for each pool, use Series ELC-810 Controller housed in a watertight NEMA 4X UL94 5V UL flammability rated polycarbonate enclosure to meet IP66 and NEMA 4, 4X, 12 and 13 ratings. The Controller must utilize one sensor to control water level. ELC-810 series must have a menu-driven LCD display screen and utilize a five-switch user interface for navigation through the menu. The menu must allow changing the following settings: delay to shutoff, alternate sensor option, maximum time on, manual override, delay to normal, type of sensor, high level option, flow sensor active, and sounder with alarm. Menu settings must be capable of password protection. The Controller must be capable of displaying the following data: last fill time, last drain time, last alarm. The Controller must be capable of determining the following: maximum time on exceeded, over current to solenoid valve, no valve/valve wiring problem, and sensor not working properly. The Controller must have a low voltage interlock with auto water make-up solenoid valve, must provide adjustable time delay for increasing level and manual override; and requires 115 VAC, 1 phase, 60 Hz power. Manufactured by AquatiControl Technology, model ELC-810-SS-ST-XXX (Coordinate the specific length(s) of cable required for each controller prior to ordering). Refer to drawings for additional information.

2. Provide a proximity switch sensor that must be sensitive to within +/- 1/8" (4mm) of nominal water level. Supply voltage to sensor must be 12V to 24V DC from Controller. Current consumption must be < or = 15mA. Response frequency must be 100Hz. Maximum control output must be 200mA. Sensor operating temperature must be -25 Deg. C to 70 Deg. C. Operating humidity must range from 35% RH to 95% RH. Sensor must be mounted in a 1" SCH80 PVC pipe (length must be determined by depth of surge tank). Sensing pipe must be mounted to surge tank wall with composite/non-metallic hangers and stainless-steel hardware. Sensing pipe must be capable of being submerged under water safely. Refer to drawings for additional information.

3. Wiring from the sensor to the Controller must be provided and must be connected to the terminal points mounted within a corrosion resistant, nonmetallic NEMA 4X enclosure. Wiring connections must be made through the bottom of the enclosure. The enclosure size must be no less than 8" wide x 5" high x 4" deep. The access door must be the entire front face panel of the enclosure. Confirm location in field.

4. Major components must be plugged in using WAGO terminal blocks for ease of installation and replacement. Unit must be designed to activate a 24-volt AC solenoid valve.

5. Provide a make-up water solenoid valve, normally closed, stainless-steel fitted, bronze body, 24 VAC slow closing type. Size to pipe. Interlock with automatic water level control system. Refer to the Drawings for additional information. Such as ASCO or approved equal.

6. Discharge of make-up water must be into a fill funnel and piping to the surge tanks. Refer to the Drawings for additional information.

7. Provide a make-up water solenoid valve, normally closed, stainless-steel fitted, bronze body, 24 VAC slow closing type. Size to pipe. Interlock with automatic water level control system. Refer to the Drawings for additional information. Such as ASCO or approved equal.

8. Discharge of make-up water must be into a fill funnel and piping to the pool(s). Refer to the Drawings for additional information.

2.10 DECK EQUIPMENT, INSERTS & ANCHOR SOCKETS

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. Grab rails must be provided as required in the quantities and to the dimensions as shown on the drawings. Grab rails must be fabricated of one continuous length of polished and buffed tubing. The tubing must be ASTM-A-554 grade 304L stainless-steel, 1.50-inch OD x 0.120-inch minimum wall thickness, polished and buffed to 320 grit finish and must be passivated, in compliance with ASTM A967-99, incorporating organic acid passivation techniques for maximum corrosion resistance. Bends must be smooth and free of wrinkles. Grab rails must be pretzel bend style with dimensions as indicated in the plans and as manufactured by Spectrum Products, SR Smith, Paragon or approved equal. . Anchor sockets for grab rails must be of the wedge type, cast bronze or stainless-steel, 4 inches in depth and made to receive 1.50-inch OD tubing as manufactured by Paragon #28105, SR Smith #AS-200B, Spectrum #54052 or approved equal. The wedge must be cast bronze, incorporate a stainless-steel tightening bolt, and flat washer, and be designed as the sacrificial element to the anchor system. Metallic components must be passivated, in compliance with ASTM A967-99, incorporating organic acid passivation techniques for maximum corrosion resistance. Anchors must be provided with flush closure caps and escutcheons with set screws where indicated. Escutcheons must be of the keyhole or oblong shape, similar to the casted, electro-polished stainless-steel escutcheon with set screw by Paragon #28303SS, SR Smith #IEP-200, Spectrum #24095 or approved equal.

2. Recessed steps must be a single molding of white ABS with an integral slip resistant tread surface. The step must be 16.5 inches wide by 6 inches deep. Portions of the backside must be completely filled with non-shrink grout and set into the wall block-out and mortared in with non-shrink grout. Steps by Paragon, S.R. Smith, Spectrum Products or approved equal.

3. Stanchion posts (backstroke and false start) must be provided as required and in the quantities shown on the drawings. The posts must be a straight length of type 304L stainless-steel tubing, 1.90-inch OD x 0.145-inch wall thickness x 8-foot overall length, polished and buffed to 320 grit finish. Stanchions must be capped at one end with a closure plug containing a U-shaped hook and fitted with a stainless-steel eyebolt attached to an adjustable nickel-plated bronze sliding collar. Stanchion with sliding collar and eyebolt as manufactured by Paragon #38106 with #38301, SR Smith #10167-MG with #35-102, Spectrum Products #23614 with #23625 or approved equal. Anchor sockets for stanchions must be of cast bronze or stainless-steel, sized to receive a full 6 inches penetration of 1.90-inch OD tubing as manufactured by Paragon #38201TC, Spectrum Products #23626, Kiefer #700103, SR Smith #AS-100D or approved equal. Each anchor socket must be provided with a flush threaded, vandal proof closure cap Paragon #38201TC, Spectrum Products #23628, or Kiefer #700103C and a grounding lug with screw. Provide Paragon #38303, Spectrum Products #23630, Kiefer #700103K or approved equal spanner wrenches for removing the closure cap. Anchors or sockets must be provided with flush closure caps and escutcheons with set screws where indicated.

4. Starting Platforms

a. Single post starting platforms for the competition pool rollout gutter(9 required, 8 plus 1 spare) must have number plates on both sides numbered 1 through 8. Spare block must not be numbered. Platform block height must be 29-1/2" inch above water level. The platform top (24" wide x 32" deep) and intermediate rear step (8" x 12") must be constructed of UV inhibited high density polypropylene. The surface must have a non-skid dual cross-grooved sand textured finish. The top must be permanently positioned at a 10° tilt towards the pool. Frames must be 2.5 square inch x 0.125-inch wall thickness 304 stainless-steel tubing with a powder coated finish. Architect/Owner to select colors. Verify height of platform above water before ordering. Backstroke bar must be 1" diameter and allow both horizontal and vertical grab positions. Blocks must have raised side grip handles and adjustable back plate. Platforms must be custom blocks as detailed on the plans similar to the Track Start Quickset with adjustable backplate and hand grip kit by Paragon, Velocity with adjustable backplate and side handle option by SR Smith, Riptide with adjustable backplate and hand grip option by Kiefer, Xcellerator by Spectrum Products or approved equal. Each starting platform must have two labels affixed

stating "Warning – For Use by Trained Competitive Swimmers Only – Execute Shallow Racing Dives Only - Impact with Pool Bottom Can Cause Permanent Injury."

b. Anchors sockets for single post starting platforms located on the rollout gutter must be designed to prevent rocking. A stainless-steel cap must be provided to flush mount on the deck when platform is removed. Anchor socket must be cast T304 stainless-steel with wedge assembly consisting of a bronze wedge and T304 stainless-steel hardware. Anchors for starting platforms must be by the starting block manufacturer - Paragon Quickset Dual-wedge anchor, SR Smith Rock Solid anchor, Spectrum Products Record Breaker anchor, or Kiefer Riptide anchor.

c. Starting platform safety covers (10 required) are designed to keep unwanted users off starting platforms. The cover is made of 1/16" thick tough, lightweight plastic with a UV stabilizer and fits 24" x 32" platform tops. The conical shape and safety orange color act as a deterrent of stating platform use. Each cover is provided with a bungee cord for securing cover platform top.

5. Lifeguard Chairs

a. Lifeguard chairs must be constructed of UV inhibited recycled HDPE chairs. Maximum seat height must be 36"/ 48"/ 66" above the pool deck. Joints must be secured using T- 316L stainless-steel screws. Chair must include umbrella guide and holders. Refer to architect for color.

1) (NOTE TO SPECIFIER: 36" seat height): Lifeguard chairs (2 required) must be Spectrum Products Mendota #42022, Tailwind Furniture #LG505, Kiefer Forever Guard Chair #500232, SR Smith Sentry #SLGC30 or approved equal.

2) (NOTE TO SPECIFIER: 48" seat height): Lifeguard chairs (2 required) must be Spectrum Products Mendota #45023, Tailwind Furniture #LG510, Kiefer Forever Guard Chair #500231, SR Smith Sentry #SLGC42 or approved equal.

3) (NOTE TO SPECIFIER: 66" seat height): Lifeguard chairs (2 required) must be Spectrum Products Mendota #45023, Tailwind Furniture #LG510, Kiefer Forever Guard Chair #500231, SR Smith Sentry #SLGC66, or approved equal.

6. Surge tank access hatch (2 required) must be provided as shown on the drawings. The access hatch must be a single door 3'-2" x 2'-6" with 1" fillable pan to receive ceramic tile and grout or concrete fill to match the surrounding deck. The frame must be ¼ inch extruded aluminum with built in neoprene cushion and continuous anchor flange. Door must be ¼" aluminum plate reinforced with aluminum stiffeners as required. Door must be equipped with heavy continuous stainless-steel hinges and must have compression spring operators for easy operation. Door must open to 90 degrees and lock automatically in that position. Door must be built to withstand a live load of 150 lbs. per square foot and equipped with a continuous Type 316L stainless-steel hinge, tubular type, and an automatic hold open arm with release handle. Hardware must be type 316L, 18-8, stainless-steel. A flush lift handle and a snap lock with removable key wrench must be provided. Factory finish must be mill finish with bituminous coating applied to the exterior of the frame. The access door must be Type TER-3 single leaf pan type door as manufactured by the Bilco Company.

7. Sleeves for surge tank valve extensions must be Spectrum Products Valve Extension Body #1910387 with Lid and Key #36450, or Spectrum Products Bronze Anchor Kit 1.90-inch O.D. x 6-inch-deep Anchor (field modification required) with Lid and Key #23638-00.

8. Surge tank and backwash catch basin ladder rungs must be ½ inch Grade 60 steel encased with co-polymer polypropylene plastic as manufactured by M.A. Industries, Inc, or approved equal.

9. Pool Lift

a. Pool lift (2 required) must be a battery powered handicap lift with footrest assembly. Lift must comply with the Americans with Disabilities Act Access Guidelines (ADAAG), be capable of lifting 300 lbs, and must include a seat belt assembly. The following accessories must also be provided: caddy, arm rest assembly, lift cover, extra battery, wired controls Stainless-steel components must be 304L. Lift must be a SR Smith Splash Aquatic Lift

Extended Reach #370-0000, Spectrum Products Horizon Long Reach BP 300 #2030086, Aqua Creek Products LLC Mighty 400 #F-MTY400 or approved equal. Confirm pool lift fits on pool perimeter and operates correctly.

b. The anchor for the pool lift must be furnished with the lift. The anchor must be an embedded sleeve made of glass reinforced copolymer, 300 series stainless steel, or bronze. The depth of the anchor must be 6 inches, and the anchor must include a lug for proper bonding with the pool structure. The anchor must be installed in accordance with manufacturer's instructions, including required or recommended support footings. Manufacturer must provide an anchor cap and key for times when the lift is not in use. Sockets must be provided as stainless-steel or cast bronze for swimming pool accessories.

10. Provided a ship's ladder or Lapeyre Stair in the size and shape shown on the drawings. Ladder must be aluminum with aluminum stiffeners if required by OSHA. Refer to the Architect.

2.11 LOOSE EQUIPMENT

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. Competition floating lane ropes must be as shown on the drawings and described in these specifications. Floating lane ropes must be a non-turbulent type with wave quelling floats and 3/16" stainless-steel coated cable. Floats must be injection-molded polyethylene. Colors to alternate the length of the pool with a contrasting solid color for the final 15 feet (Architect/Owner to select colors). Floating lane ropes must be provided as completely assembled and installed with take up reel, type 304 stainless-steel spring and cable lock, hooks, and wrench. 5/8" wrench must be made of a forged steel shaft with a polished chrome finish. The take up reel must be constructed of type 304 stainless-steel. The spool must be a bronze nickel-plated casting with a nylon sleeve. Floating lane ropes must be similar to Competitor Swim Products, Competitor Gold Medal 6" Racing Lanes, Kiefer Advantage II (6") Racing Lanes, or Anti-Wave Maximum (6") Racing Lanes. Provide lane rope extension hooks as detailed on the drawings complete with protective sleeve. Provide contrasting disks located 15 meters from each end to meet resurfacing requirement. This requirement must be met for each possible course length.

Quantities:
Competition Pool: Provide 10 at 25 yards

2. Cup anchors for floating lane ropes must be incorporated into the perimeter overflow system. Cup anchors must be 316L stainless-steel with stainless-steel threaded eyebolts. The heavy-duty cup anchors must be 3-3/8-inch diameter. Cup anchors must be Spectrum Products #58280, SR Smith #WA-100, Paragon #14-503 or approved equal.

3. Backstroke flags:

a. Backstroke flags must be made of Nylon material, triangular in shape (12" wide x 17" long), and alternating in color, and sewn onto a Nylon tape. Additional tape must be provided at both ends for fastening to the stanchions. Submit samples for review and approval. Equipment must be Kiefer Nylon Backstroke Flags (#600120), with braided nylon cord and snap hook on each end (#600806) or approved equal from Competitor Swim Products.

4. Recall rope must be 1/2-inch yellow polypropylene rope complete with weight rings and two quick snap connectors made of chrome-plated brass. The rope must consist of a neco plate constructed of soft aluminum that is crimped and used to connect the two pieces of rope to form the required loops. Recall rope must be Recreonics, #92-967.

5. Lane Rope Storage Reel

a. Lane rope storage reel must be fabricated from two powder-coated enclosed aluminum wheels joined together by a 1-1/4-inch aluminum axle. This unit must ride easily on four 6" stainless-steel casters with individual brakes. The reel must have a collapsible tow handle for safe

movability. The storage reel should be able to hold 902' of 4" lane ropes or 492' of 6" lane ropes. The storage reel must come assembled. The correct number of storage reels must be provided to store the lane lines. Lane line storage reel must be Competitor Swim Products Elite Stor Lane Reel #200 850 with Competitor storage reel cover #200 861, SR Smith XL Capacity Lane Line Reel #38000 with SR Smith lane line reel cover #36100 or approved equal.

6. Lifeline must be 3/4-inch blue and white polyethylene rope with floats that are 5-inch diameter by 9-inch-long. Floats must be spaced on five-foot centers. Metallic rope hooks must be stainless-steel. Provide lifeline at five-foot break between shallow and deep water as shown on the drawings. Lifeline must be equal to Recreonics #14-438.BW or Lincoln Aquatics #44-115 safety line rope, Recreonics #14-381, Lincoln Aquatics #44-190 or Competitor Swim #350EZBW locking 5" x 9" floats, and Recreonics #14-456 or Lincoln Aquatics #44-125 rope end hooks.

7. T-wrench for operation of valve extensions must be fabricated of ¾" diameter SCH 40 stainless-steel pipe. The T-wrench must be 4'-0" in length with a 24" long welded "T" handle. The wrench must be fitted with a ¾" square stainless-steel male end, 1" in length, for operation of valve extensions at the surge tank. Two complete T-wrenches must be provided.

2.12 MAINTENANCE EQUIPMENT

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. Wall brush (2 required) - Brush backing must be a flexible polyethylene material with five (5) rows of nylon bristles. Pool brush holder must be permanent mold cast aluminum with hydrofoil flap. Holder must have stainless-steel screws to facilitate brush changes. Handle bracket must be quick detachable mount to fit standard 1 ¼ or 1 ½ inch diameter handles. Brush must be Recreonics #10-135, Lincoln Aquatics #31-020, or approved equal.

2. Skimming net (2 required) - Skimmer head must consist of one-piece molded plastic frame with a reinforced, integral handle bracket suitable for quick attachment to a standard 1¼ or 1 ½ inch diameter handle using bolts and wing nut. The standard nylon net must be attached to the frame using the groove and spline method. Net depth must be 16 inches minimum in the center. Skimming net must be manufactured by Recreonics #10-124, Lincoln Aquatics #31-103 or approved equal.

3. Telescopic Poles (2 required) - Cleaning tool handle must be of the telescopic design and fabricated from corrosion resistant, high-quality anodized aluminum. Poles must be fully adjustable, to desired length, with a simple twist of a cycolac threaded locking device. Poles must consist of a 1-inch tube fitted inside a 1¼ inch tube and be adjustable from a range of 8 ft. to 16 ft. Handle must be adjustable from 8 ft. to approximately 16 ft. having a threaded bushing type clamp to lock handle at desired position. Poles must be Recreonics #10-323, Lincoln Aquatics #30-050 or approved equal.

4. Portable Vacuum Poles

   a. Stainless-steel poles (2 required) –Vacuum head attachment poles are to have a heavy-duty 1¼ inch stainless-steel handle with special brass male and female threaded inserts on the ends. Poles must be 8 ft. each, totaling a 24 ft. length for vacuum head attachment. Poles must be Recreonics #10-330 with female thread adaptor Recreonics #10-335 or approved equal.

5. Test Kits

   a. Provide two (2) test kits:

      1) The first test kit must feature liquid reagents, color comparator, waterproof instructions and treatment charts, chemistry guide and water gram. Test kit to have the ability to test for free and total chlorine (0.5 – 5.0 ppm), bromine (1-10 ppm), pH (7.0 – 8.0), acid and base demand, total alkalinity, calcium hardness and cyanuric acid. Test kit must be Taylor Complete 2005 test kit or approved equal.

2) The second test kit must be photometric and utilize tablet reagents for stability that will allow accurate measurement of free and total chlorine (0-10 ppm), bromine, pH, alkalinity, calcium hardness, and cyanuric acid. The test kit must have solid-state digital electronics and built-in filters. The test kit must be direct reading with automatic blank settings, automatic power cut-off, and store the last 10 results in nonvolatile memory. Provide LMP106C Pooltest 6 with Hard Carry Case Kit and LMC001 Check Standard by Lumiso, AquaPRO 6 Test Kit manufactured by Orbeco-Hellige Inc and Reference Standard Kit (LP275680) or K-2010-CH by Taylor Technologies or approved equal.

6. Vacuum Cleaner

a. Vacuum cleaner (filtered water return to pool) - (2 required) must be complete with a 36-inch dual manifold head with 50 feet of 1-1/2-inch floating hose. Hose must be Recreonics, #10-414 Lincoln Aquatics #29-114 or approved equal. 24 ft. stainless-steel pole must be available for attachment. The portable cartridge vacuum cleaner system must include a 155 square foot T-316 stainless-steel up-flow single cartridge filter, a 1 HP self-priming thermoplastic self-priming pump 1-1/2-inch suction and discharge connection and 110 cubic inch strainer capacity. Cartridge must be Harmsco #ST/155 or approved equal. The system must be provided with one spare cartridge filter. The pump motor is 115-volt single phase, open-drip proof and must be UL and NSF listed. The pump motor must be provided with a 120-volt Hubbell switch, weatherproof switch cover, in-line pre-wired GFCI and a 100' power cord. The cord must be wired to a 20-amp, 115-volt switch which must be mounted on pump motor. Interconnecting pipe and fittings must be schedule 40 PVC. The entire assembly must be bolted to a T-316 stainless-steel cart and must have pneumatic wheels with grease fittings and roller bearing hubs. Unit must be Recreonics #10-806, Lincoln Aquatics #27-010 or approved equal. Accessories must include a 1-1/2-inch x 25 ft. discharge hose with stainless-steel hose clamp. Hose must be Recreonics #10-440, Lincoln #29-140 or approved equal.

7. Robotic Pool Cleaner

a. Provide one (1) single pump floor, wall, and waterline automatic commercial robotic pool cleaner. The cleaner must filter up a minimum 4,500 gallons per hour. Unit must have two different cleaning cycles settings. The pool cleaner must be provided with a minimum 98 feet of cable, PVC/PVA brushes, one (1) filter bag and a remote control for "spot cleaning". Features must include zero-depth entry sensor and transportation caddy. Unit requires a dedicated 120-volt circuit receptacle with GFCI to transform which provides 24 volts to the automatic pool cleaner. The automatic pol cleaner must be #9999096X-USW WAVE 100 as manufactured by Maytronics USA, #RUCM-MAG0-MGA00 Magnum as manufacturer by Aquatron Robotic Technology or approved equal.

b. Provide one (1) dual pump floor, wall, and waterline only automatic commercial robotic pool cleaner. The cleaner must provide up to 5,820 square feet per hour of cleaning coverage as well as filter up to 9,000 gallons per hour. Unit must have 4-, 6- and 8-hour cleaning cycles. The pool cleaner must be provided with 131 feet of cable, PVC brushes, two (2) bottom loaded filter bags and a remote control for "spot cleaning". Features must include zero-depth entry sensor and transportation caddy. Unit requires a dedicated 120-volt circuit receptacle with GFCI to transform which provides 27 volts the automatic pool cleaner. The automatic pol cleaner must be #9999359-W120 WAVE 120 as manufactured by Maytronics USA or approved equal.

2.13 SAFETY EQUIPMENT

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. Ring buoy and extension rope (2 required) – Buoy must be 24-inch diameter vinyl clad PVC foam with a metal ring molded inside. Buoy must have a 3/8-inch polyethylene rope attached to it at four points

and be a minimum 60 feet in length. Preserver must be U.S.C.G. approved. Buoy and rope must be mounted at each lifeguard chair on hooks. Ring buoy must be Recreonics #12-252, Lincoln #44-075 or approved equal. Throw rope must be Recreonics #12-261, Lincoln Aquatics #42-050, or approved equal.

2. Life hook and pole (2 required) – Life hook must be an anodized aluminum 3/8-inch OD "shepherd's crook" with a 1-1/8-inch OD handle attachment suitable for a 1¼-inch 16 ft. aluminum extension pole. Hook must be of looped construction. Each pole must be provided with a set of spring type stainless-steel pole clamps for mounting on each lifeguard chair. Life hook must be Recreonics #12-239, Lincoln #42-060 or approved equal. Pole clamps must be Recreonics #10-353, Lincoln #30-135, or approved equal.

3. Spineboards (2 required) - Spineboard must be 72" long x 20" wide, constructed of 100% virgin high density polyethylene. The design must provide stiffness and torsional rigidity while remaining lightweight. The spineboard must accommodate up to 500 lbs and must feature customizable buoyancy that allows users to adjust the buoyancy by inserting polyethylene foam rods (supplied with the spineboard). There must be (10) handholds around the perimeter of the board. The spineboard must be supplied with one (1) 2-piece head immobilizer, one (1) head strap, four (4) body straps, one (1) head immobilizer with head bed, and two (2) flotation rods. The spineboard must be CJ Rescue 6 package as manufactured by CJ spineboard or approved equal. Provide one (1) set of heavy-duty stainless-steel utility hooks per spineboard for storing the spineboard at a convenient and readily accessible location near the pool (Recreonics #10-362).

4. First aid kit (1 required) - First aid kit must be a 24-unit kit per American Red Cross standards as manufactured by Swift First Aid, Recreonics #12-013, Lincoln #47-084 or approved equal.

5. Bloodborne pathogen kit (1 required) – Bloodborne pathogen kit must include a protective gown, medical-grade latex gloves, face mask with eye shield, antimicrobial hand wipes, and body fluid clean-up supplies. Kit must include a wall-mountable hard storage case. Bloodborne pathogen kit must be Recreonics #12-041, Lincoln Aquatics #48-056 or approved equal.

6. Rescue tube (2 required) - Provide one rescue tube for each lifeguard chair. Rescue tube must be Recreonics #12-293, Lincoln #42-030 or approved equal.

7. Safety eyewash station (1 required) - Safety eyewash station must be a self-contained system in which eyewash bottles are securely positioned in a portable holder. Eyewash bottles must be 32 ounces and easily removable from case, and must contain a sterile, saline solution with the ability to neutralize a varying quantity acids or caustics. Eyewash stations must be equipped with a double back screw and holes for easy mounting in location determined by the Architect. Stations must be Recreonics #12-033, Lincoln Aquatics #49-026, or approved equal.

8. Safety eyeglasses - Provided a safety eyeglass dispenser station containing ten (10) pairs of safety glasses. Eyeglasses must be ANSI/OSHA accepted.

9. Bag Valve Masks – Provide two (2) bag valve mask assistant resuscitation systems, one size Adult (1500ml tidal volume) and one size Infant/Child (450ml tidal volume). Product must be a latex free disposable bag mask unit with support strap, transparent patient valve, and textured surface to eliminate slipping. Integral swivel valve, available with a closed reservoir system. Standard pack includes resuscitator, oxygen reservoir and a transparent bag for storage. Bag Valve Masks must be Ambu SPUR II or approved equal.

10. AED – Provide two (2) Automated External Defibrillator and one (1) trainer AED corresponding to the chosen AED per facility level for the aquatic facility. Product location must be coordinated with the Owner and Architect. AED must be Recreonics #12-430, Lincoln Aquatics #48-013, or approved equal and must have an available training AED device. AED Cabinet must be Recreonics #12-434, Lincoln Aquatics #48-023, or approved equal.

2.14 THERMOMETERS

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. Portable thermometer (2 required) must be a molded ABS plastic tube body type with the ability to measure temperature in both degrees Fahrenheit and Celsius. A 3 ft. polyethylene cord must be attached to thermometer. Thermometer must be manufactured by Pac-Fab/Rainbow #R141036 or approved equal.

2. Inline thermometer must be near the heating loop and must have a 9-inch adjustable angle with a minimum 6-inch stem. There must be a minimum of two (2) thermometers per loop and must have ability to read temperature in both degrees Fahrenheit and Celsius. Thermometers must be Recreonics #32-702, Lincoln Aquatics #21-125, or approved equal.

2.15 SWIMMING POOL FINISHES

A. Paint

1. The leisure pool zero entry and interior surfaces of the gutter trough must be painted with a high build epoxy. The color must be white or an approved light color.

2. Coating must be a low VOC compliant polyamidoamine epoxy suitable for chlorinated water below 3.2 ppm and for installation on concrete surfaces. Coating must be Tnemec L69 Hi Build Epoxoline II, Induron Perma-Clean II Epoxy or approved equal. Color must be white.

3. Quality Assurance

a. At least ten (10) commercial public-use pools with individual water surface areas in excess of 4500 square feet of pool surface area or more must have been completed within the past 5 years by the painting contractor.

b. Submit a letter of approval from the pool paint manufacturer prior to application of the pool paint. Provide manufacture with required estimated square footage to ensure proper material usage.

4. Surface Preparation

a. Cast-In-Place Concrete

1) Allow concrete to cure a minimum of 28 days per ACI 308 and specification 131101 - Swimming Pool Cast-in-Place Concrete. Perform moisture test of the concrete to ensure dryness. Either the plastic sheet method test (ASTM D 4263) or the Anhydrous Calcium Chloride Test (ASTM F 1869) must be performed prior to painting. Document test with pictures and submit results for record.

2) Brush-off pool interior surfaces, then blast clean to remove laitance and weak surface concrete, foreign substances and debris that could reduce or impair adhesion, dirt, oil, grease, curing compounds, or other foreign materials, to produce an anchor profile similar to medium grade sandpaper referencing SSPC-SP13/NACE6 and ICRI-CSP 2-4 Surface Preparation of Concrete. Blasting must open up surface voids, holes, and irregularities. No holes or holidays in the paint surface are allowed. Fill holes or irregularities that cannot be satisfactorily painted with an approved grout or Tnemec Series 215 Surfacing Epoxy, Induron EFS707 Epoxy Surfacer and Filler or Induron Mortarchem. Do not entirely remove the surface or completely expose underlying aggregate.

b. Pneumatically Applied Concrete

1) Allow concrete to cure a minimum of 28 days per ACI 308 and specification 131102 – Swimming Pool Shotcrete. Perform moisture test of the concrete to ensure dryness. Either the plastic sheet method test (ASTM D 4263) or the Anhydrous Calcium

Chloride Test (ASTM F 1869) must be performed prior to painting. Document test with pictures and submit results for record.

2) Prior to applying paint to a pneumatically applied concrete surface, a brown coat plaster leveling surface must be applied. The pneumatically applied concrete surface must be prepared for the application of the brown coat by removing foreign substances and debris that could reduce or impair adhesion, dirt, oil, grease, curing compounds, or other foreign materials. Brown coat must be applied to provide a clean, firm surface similar to a medium grade sandpaper, suitable for the application of paint. No holes or holidays in the paint surface will be allowed. Fill holes or irregularities that cannot be satisfactorily painted with an approved grout or Tnemec Series 215 Surfacing Epoxy, Induron EFS707 Epoxy Surfacer and Filler or Induron Mortarchem.

5. Application Procedures

a. Before applying material, measure and record the temperature and relative humidity. Apply only if surface and air temperature is above 50°F and at no lower temperature than 5°F above the dew point, unless otherwise approved by the manufacturer. Low temperature cure option must be submitted for approval if required. Do not apply when the relative humidity is greater than 85%. If possible, plan the painting schedule so that painting is done in the coolest part of the day. Provide adequate ventilation during application to minimize odor.

b. Protect exposed tile during preparation and application procedures.

6. Application of the First Coat

a. After the pool surface has been thoroughly dried and cleaned the first coat can be applied. Surface spreading rate must be observed as not to exceed the recommended manufacturer's rate of application. The first coat must be applied at a minimum rate of 200 SF per gallon and must conform to local VOC requirements. First coat must be thinned 10%. First coat must be allowed to cure for 12 hours at a minimum temperature of 70°F prior to second coat, unless otherwise approved by the manufacturer. Low temperature cure option must be submitted for approval if required.

7. Application of the Second Coat

a. After the first coat dries, the second coat must be applied at a minimum rate of 200 SF per gallon and must conform to local VOC requirements. Second coat must be allowed to cure for 12 hours at minimum temperature of 70°F prior to final coat, unless otherwise approved by the manufacturer. Low temperature cure option must be submitted for approval if required.

8. Application of the Final Coat

a. After the second coat dries, the final coat must be applied at a minimum rate of 200 SF per gallon and must conform to local VOC requirements. Slip resistant additive (rounded dry silica sand) must be applied with the final coat to required areas as shown on the contract documents including but not limited to the zero entry. Remove loose sand after the final coat has cured by sweeping or vacuuming. Final coat must be allowed to cure for 7 days at 70°F before filling the pool, unless otherwise approved by the manufacturer. Low temperature cure option must be submitted for approval if required.

9. Specialty Paint

10. Application of the Finish

a. Application must be made by brush, roll, lamb's wool applicator or spray.

B. Pool Cementitious Finish, Diamond Brite, Pebble Tec/Pebble Sheen. Reference specification section 131104, Swimming Pool Cementitious Finish.

C. Pool Tile – Reference specification section 131103, Swimming Pool Tile.

2.16 WATERPROOFING

A. Products

1. Interior surfaces of the surge tanks and backwash pit with NO additional finishes: Apply two (2) coats of Vandex BB White, Xypex Modified, Xypex Megamix I, Miracote BC Pro or Basecrete directly to the surface of the surge tanks and backwash pit.

B. Surface Preparation

1. Surface must be structurally sound and free of foreign substances and debris that could reduce or impair adhesion. Surfaces must be roughened by sand blasting or water blasting. Shot blasting, scarifying, or grinding can also be accepted methods of surface preparation. Surface defects or holes must be patched per manufacturer's recommendations.

a. National Plasterers Council Surface Preparation Definitions

1) Pressure Washing: The washing or cleaning of a surface by a stream of water ejected from a nozzle at high velocity, typically in the range of 1,000 psi – 4,000 psi.

2) Water Blasting: The cutting, abrading, or removal of a surface or substrate by a stream of water ejected from a nozzle at ultra-high velocity, typically in the range of 10,000 psi – 40,000 psi.

C. Application

1. Do not apply materials under conditions where the ambient air temperature is less than 40 degrees Fahrenheit, or to a frozen substrate.

2. Mixing of products, quantities and application procedures must be done in accordance with the manufacturer's recommendations.

2.17 SEALANTS

A. Provide sealed expansion joints as shown on the pool and pool structural drawings or noted on the construction/expansion joint layout, and as required. Expansion joints must be constructed and sealed as indicated and in accordance with the manufacturer's recommendation. Sealant must be manufactured by LATICRETE International, Inc., Mapei, or Deck-O-Seal.

1. For submerged joints:

a. Latasil, one component, neutral cure, high performance, 100% silicone sealant in the color(s) as selected. Must be used in conjunction with Latasil 9118 Primer per manufacturer's recommendations.

b. Mapesil T, 100% silicone sealant in the color(s) as selected.

2. For joints behind the coping, or other horizontal deck joints:

a. Deck-O-Seal, two component (gun-grade or pourable, self-leveling), high resilience, non-sag, non-flowing, polysulfide-based sealing compound in the color(s) as selected. Must be used in conjunction with P/G Primer per manufacture's recommendations.

B. Material Storage

1. Materials must be stored in the original unopened factory containers in a cool dry location at 60 to 80 degrees F. Protect from the elements and the hazards of construction.

C. Joint Preparation

1. Clean the joints of deleterious material, to sound, clean and dry substrate.

2. Joint must be formed or filled with an approved, resilient, non-asphaltic, closed cell, polyethylene joint filler material down to firm substrate. Allow space at the top of the joint for the installation of approved closed cell polyethylene backer rod and install same to the required depth below the surface of the slab to control the depth of the sealant bead to within manufacturer requirements.

D. Surface Preparation

1. Concrete surfaces to receive sealant must be fully cured, clean, dry, and free of dirt, dust, curing compounds and other foreign material that might compromise the adhesion and performance of the sealant. Curing aids, form release agents and joint former residue must be completely removed, if necessary, by sand blasting and/or grinding. Loose dust must be brushed off.

2. Prime surfaces to receive Latasil sealant with Latasil 9118 Primer prior to sealant application, and surfaces to receive Deck-O-Seal sealant with P/G Primer prior to application.

E. Application

1. Apply sealant in accordance with the manufacturer's recommendations.

2. Tool the joint immediately after application to ensure a firm, intimate contact with the joint interface.

3. Remove excess sealant and smears from adjacent surfaces with Xylol or Toluol before sealant cures.

4. After the sealant has fully cured (generally a minimum period of five days at 72 degrees and 50% humidity), paint the surface of the sealant with a chlorine resistant chlorinated rubber or equivalent pool paint, such as Ramuc, in a compatible color as selected by the Architect. NOTE: Latasil cannot be painted.

2.18 UNDERWATER LIGHTS

A. Underwater lights must be equivalent to 500 watts of incandescent light. Underwater lights must be UL listed and, in the quantities, shown and as detailed in the construction drawings and as described in these specifications. Coordinate for proper installation. Refer to the drawings for quantities and locations.

B. The pool underwater lights must be 12VAC, 55 watts LED-type, and equivalent to 500 watts of incandescent light. Fixture housing must be stainless-steel construction with minimum wall thickness of 0.020 inch per UL 676 underwater pool lighting standard. The niche must be stainless-steel with cast brass mounting ring or PVC plastic with stainless-steel mounting ring. Brass construction pressure grounding lug on interior and exterior services. Lens must be 8-3/8 diameter clear tempered heat resistant glass. Gasket must be single piece "U" shaped santoprene or silicone. Fasteners must be silicon-bronze or stainless-steel. The light fixture must be supplied with a #16-3 STW (120V) or 12-3 SJTW (12V) submersible cord with ground wire positively grounded inside the fixture. Cord entrance must be a watertight seal and epoxy encapsulated. Light fixture must be IntelliBrite 5g White LED pool light series by Pentair Commercial Pool and Aquatics or approved equal. Underwater lights must be provided with cord length as required to allow for deck relamping of fixtures.

C. Junction boxes must be provided in the quantities required and must be located at least 8" above the pool coping and 5' from the pool edge. Refer to the Electrical drawings. Cord length must be sufficient to run from fixture to the junction box with sufficient cable in the niche to re-lamp the fixture on the deck. Provide junction boxes that must be installed by Electrical.

D. Transformers for 12V underwater lights must be Intermatic PX Series low voltage landscape and swimming pool light transformer or approved equal as specified by Electrical designer. These safety transformers are specifically designed to supply 12 volts to pool lights, submersible fixtures, and outdoor garden lights. The built-in circuit protection will disconnect power to the transformer in case of defect or overload. These transformers are suitable for direct connection to underwater pool and spa lights. Refer to manufacturer information for cabling distance and gauge requirements. Coordinate transformer locations with Electrical.

1. Model PX100 and PX100S: 100 W Transformers - input 120 VAC, output 12 VAC or 13 VAC

2. Model PX300 and PX300S: 300 W Transformers - input 120 VAC, output 12 VAC, 13 VAC, or 14 VAC

2.19 WATER FEATURES AND SUPPORT EQUIPMENT

A. The Bucket Trio VOR-103.2000 shall be constructed of 304/ 304L stainless steel structural tubing with an outside diameter of 4½" (11.4cm) and a wall thickness of 0.120" (3mm).

1. There shall be three (3) horizontal, interchangeable support arms extending 45" (114.3cm) from the vertical support structure, attached to the main structure using a watertight, tamper-resistant joint.

2. There shall be one (1) dumping bucket mounted to each support arm using a tamper-resistant stainless steel shaft for a total of three (3) dumping buckets. Each bucket shall be constructed of high density fiberglass, and include an integrated non-visible counterweight system. The counterweight system and selectable mounting orientation will determine each bucket's main dumping direction. The SAFESWAP™ anchoring and leveling system shall be used.

3. Overall play product dimensions: The above ground height of the structure shall be no less than 129" (328cm) with a head clearance of no less than 97" (266cm).

4. Play Product Interactivity: The Bucket Trio shall create visual interest and build anticipation as the buckets fill and then dump water in the immediate area.

5. Hydraulic Activity/Components: Each bucket shall have a 1" (2.54cm) stainless steel fill spout and an incorporated drain pilot hole to prevent an accumulation of stagnant water during non-operational hours. The volume of water dumped from each bucket shall be no less than ¾ of a US gallon (2.84 liters) and no greater than 1½ US gallons (5.68 liters).

6. Hydraulic Requirements: The combined hydraulic requirements of all three (3) Buckets shall be 9-15gpm (34.1-56.8 lpm) @ 5-10 psi (0.345 – .69 bar).

B. The Spray Cannon VOR-201.2000 shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 4½" (11.4cm) and a wall thickness of 0.120" (3mm). The barrel extremities shall be rounded with no sharp edges. The handle shall be free of pinch points, protrusions, and entrapment hazards. A recessed threaded spray cap housing at one extremity of the barrel shall be fitted with a brass 6-hole particularized soft stream spray nozzle. The arm assembly shall consist of a 2 ⅜" (6 cm) diameter semi circular support-arm welded to the post and attached to the barrel body. The arm shall allow the barrel to rotate 360° and pivot up and down 35° with no pinch points. TURNTEC™ allows the barrel to rotate 360°.The rotational joint shall be free of pinch points and contain no flexible hoses. The center point of the 80° spray zone shall be adjustable. The SAFESWAP™ anchoring and leveling system shall be used

1. Overall play product dimensions: The above ground height of the Play Product shall be 40" (101cm).

2. Play Product Interactivity: By holding the handle, the user can aim the cannon higher and lower and rotate the cannon barrel 360° while the projection spray stays within a fixed 80° zone.

3. Hydraulic Activity/Components: A spray nozzle on the cannon barrel shall produce a 6-hole particularized soft stream spray effect with an 80° spray zone.

4. Hydraulic Requirements: The hydraulic requirements shall be 4-6 gpm (15-23 lpm) @ 5-7 psi (0.3-0.5 bar).

C. The Watergarden Frog Nº1 VOR-7200.2XXX shall be constructed of stainless steel structural tubing with an outside diameter of 4.50" (11.4cm) and a wall thickness of 0.237" (6mm). The structure shall be bent with no ripples or joints. The head of the Watergarden Frog Nº1 shall consist of two welded stainless steel domes. The Watergarden Frog Nº1 shall consist of two (2) stainless steel sphere eyes with an outside diameter of 5" (12.7cm) and a wall thickness of 0,120" (3mm) and welded on the upper dome. A 4" inch solid lead free brass 360° degree Turntec™ joint consisting of a stainless steel bearing collar will allow the head to rotate 360° degrees. The Turntec™ joint shall be free of pinch points and protrusion hazards and contain no flexible hoses. The Safeswap™ anchoring and leveling system shall be used.

1. Overall play product dimensions: The overall height of the Play Product shall be no less than 24" (60cm).

2. Play Product Interactivity: Users can grab the eyes to rotate the Watergarden frog Nº1 and pour water in different directions.

3. Hydraulic Activity/Components: The Watergarden Frog Nº1 shall have one (1) 90° slot on the front of its head, resulting in a laminar water effect.

4. Hydraulic Requirements: The combined hydraulic requirements (for the regular product only) shall be 10-13 gpm (38-49 lpm) @ 5-10 psi (0.3-0.7 bar).

D. The Geyser N°1 VOR-301.4000 shall be constructed of 304/304L with an outside diameter of 3" (7.62cm). The brass spray cap shall be threaded into the geyser body using a tamper-resistant tool. Tamper resistant brass winter cap shall be included. The anchoring system shall have an integrated levelling system facillitating installation and a plumb finished to the activity deck surface.

1. Overall play product dimensions: The overall height of the Play Product shall be 0" (0 cm) above ground.

2. Play Product Interactivity: Users can touch the soft frothy water falling down in contrast to the more powerful streams spraying up from the centre.

3. Hydraulic Activity/Components: The spray cap shall have a ten (10)-hole spray pattern angled at 5° (degrees) from vertical so that multiple streams spray water out at symmetrical angles forming an elegant geyser effect.

4. Hydraulic Requirements: The hydraulic requirements shall be 4-10 gpm (15-38 lpm) @ 2-5 psi (0.1-0.3 bar).

E. ELEVATIONS™ L2-450B AQUATIC PLAY STRUCTURE

1. DESCRIPTION

   a. Multi-level aquatic play structure including; a kiddie racer and water play features.

   b. 1 Hex deck(s) 32 sq.ft. (3 sq.mt.), 1 ADA entry 32’’

   c. Total water flow of 162 gpm

   d. Refer to project drawing for footprint, model dimensions, colors and water requirements.

   e. Refer to installation overview drawings for post anchoring details and plumbing connection locations.

2. MANUFACTURER

   a. The contractor shall provide and install the following ELEVATIONS™ Aquatic Play Structure as manufactured by VORTEX Aquatic Structure Intl., 11024 Bailey Road Suite C, Cornelius, North Carolina, Unites States, 28031, 1-877-586-7839, www.vortex-intl.com.

3. MATERIALS - Stainless Steel Structural Tubing and Supports: Shall be type 304/304L stainless steel pipes, schedule 10 (0.120” (3.0mm)) minimum thickness, structurally strong, durable, and highly resistant to corrosive environments. Rigid fiber reinforced polymer (FRP) and/or molded fiberglass, PVC, filaments wound tubing, Galvanized Steel, or Aluminum shall not be utilized for components above or below the water level neither above nor below grade.

a. Play Decks, Entries and Stairs: Shall be formed from 12 GA (.105" - 2.6mm) type 304/304L stainless steel sheet with welded reinforcements. Standing surface shall be perforated for maximum water drainage and slip resistance. The Hex Deck shall have a surface area of 32 sq.ft. (3 m2) and the Octa Deck shall have a surface area of 59.1 sq.ft. (5.5 m2). Stairs shall have a minimum surface area of 4.0 sq.ft. (0.37m2) per step, a minimum depth of 14" (3556 mm) and a minimum width of 36.5" (9271 mm) per step. Entries shall be compliant with ADA regulations for transfer systems, when applicable. Protective painted finish shall integrate an anti-slip surface suitable for bare feet circulation.

b. Barrier Panels: Shall be made of transparent polycarbonate plastic sheets, clear or patterned as specified, ½" thick approved for safety glazing and barriers. The Barrier Panel shall be treated for extended UV durability, impact and chemical resistant.

c. Below Deck Barrier: Hex Decks and Stairs without vertical head clearance of a minimum of 90" (2.2 m) shall have below deck protective barriers made of clear polycarbonate transparent plastic barriers with colored graphics with a lockable door to prevent unauthorized access to valves and under deck area. Many colored graphics options shall be offered along with custom graphics.

d. Spray heads and Spray caps: Spray heads and Spray caps shall be manufactured from corrosion resistant solid Ultra-High Molecular Weight Polyethylene (UHMW) plastic, rigid UV treated polyurethane, Lead Free Brass or 304/304L Stainless Steel. Exposed hardware shall be tamper-resistant. PVC, Nylon, and Delrin™ material shall not be utilized.

e. Nozzles: Shall be manufactured from corrosion resistant Lead Free Brass or 304/304L Stainless Steel material and shall use tamper resistant tools for installation and removal.

f. Protective Painted Finish: All stainless steel parts, except noted shall be cleaned and treated before the paint process. All stainless steel parts, except noted, shall be coated with multi-layer heat-cured protective powder coating including a zinc rich primer for improved corrosion protection and a Super Durable grade polyester top coat that offers superior UV, gloss and chemical resistance; and is suitable for high traffic environments.

g. Soft-touch elastomer: TwirltecTM Rotating spheres & Toe GuardsTM shall be constructed of Soft-touch elastomer developed exclusively for the aquatic play environment and designed to safely cover accessible post bases, anchoring hardware and rotating mechanism. Soft-touch elastomer shall have flexible rubber-like characteristics, a matte highly durable and slip-resistant finish. The Soft-touch elastomer shall be UV and chemical resistant with color impregnated through the material.

h. Seeflow Polymer: The Seeflow Polymer material shall be highly translucent and colorful plastic, flat or molded to different shapes, creating colorful reflections and shadows. It shall have been developed exclusively for the aquatic play environment shall have high impact resistance and be flame retardant. The Seeflow Polymer shall have outstanding dimensional stability, chemical resistance, UV stability, and exceptional translucence.

i. Kiddie Slide: Shall be molded and constructed of high quality marine-grade fiberglass (FRP) using ISO polyester 0.020" (0.5mm) thick UV resistant gelcoat, ISO and ORTHO polyester resin and E glass type fiber reinforcement. Slide wall thickness shall be a minimum of 0,150" (4.0mm) with additional fiber and foam reinforcements integrated to sliding surfaces and/or flanges. Sliding surface finish shall be 600 grit or better.

3. MOUNTING AND ASSEMBLY HARDWARE

a. All hardware and anchoring systems shall be using 316/316L stainless steel corrosion resistant hardware, except when noted inside product specification.

4. WATER DISTRIBUTION MANIFOLD

a. **Water distribution system consisting of a standalone post connected to an embedded SafeswapTM anchor and linked to the play structure via flexible water hoses. The Water** Distribution Manifold shall be located under main decks. The number of manifold per structure depends on the amount of water features and the required water flow. The Water Distribution Manifold consists of a main pipe divided in multiple water outputs and valves to permit water flow adjustment for each output line.

b. Main Body: Shall be constructed of stainless steel structural tubing with an outside diameter of 4.50 (1143 mm) and a wall thickness of 0.120" (3 mm) minimum. The Main Pipe shall have a bottom flange to connect to a Safeswap™ embedded anchor. The output water connection shall be 1.5 (38 mm) NPT female stainless steel coupling welded to the main body.

c. Valves: Valve shall be commercial grade 1.5 (38 mm) PVC ball valve.

d. All valves are suitable for swimming pool/chlorinated water environment. One valve shall be connected to each output coupling.

e. Painted finish: All stainless steel parts, except noted, shall be cleaned and treated before the paint process. All parts shall have a heat-cured primer powder coating for corrosion protection and all parts shall be top coated with a heat-cured powder coating that is UV, chemical resistant and suitable for public spaces.

f. Hardware: All hardware shall be constructed of 316/316L marine grade stainless steel.

g. Hydraulic: The hydraulic capacity shall be 200-250 gpm (757-946lpm) @ 20 psi (1.38 bar) at connection points.

5. PLAY FEATURES AND WATER PLAY FEATURES

a. **Cascade Basins, Cascade Basins & Ponds:** Interactive water feature consisting of multi-level ponds with a water feed starting from a deck level upper bowls cascading water into the ponds below.

1. Bowls: Shall be molded in a funnel shape of a 18” (460 mm) diameter and 11,25” (286mm) height, colored (specified) translucent Seeflow™ Polymer shape installed on top of a structural vertical post or supported by a stainless steel arm attached to the play structure.
2. Waterways & Bowls: Shall be constructed of colored, translucent Seeflow™ Polymer.
3. Hardware: All hardware shall be constructed of 316/316L marine grade stainless steel.
4. Hydraulic: The hydraulic requirement shall be 6 gpm @ 5 psi (23 lpm @ 0.3 bar).

b. **Spinner:** Overhead water feature consisting of a spinning translucent Seeflow™ wheel propelled by the water.

1. Wheel: Shall be constructed of a 30” (762 mm) diameter, colored translucent SeeflowTM Polymer shape installed on a stainless steel shaft welded at the end of the hemisphere on structural post.
2. Post: Shall be constructed of stainless steel structural tubing with an outside diameter of 4.50" (1143 mm) and a wall thickness of 0.120" (3 mm) bent from a vertical shape to a horizontal plan capped with a stainless steel hemisphere.
3. Hardware: All hardware shall be constructed of 316/316L marine grade stainless steel.
4. Hydraulic: The hydraulic requirements shall be 30-40 gpm @ 5-10 psi.

c. **Twinflow:** Water play feature forming two soft water falls on each side of the barrier, one side flowing on the deck and one side flowing outside the platform. Located within an Elevations barrier and connected to a main post through a static lateral joint, it is easily accessible for users. The water effect is inclined to form two different water falls where users can either sit underneath and play through the soft water on one side or go to the outside of the deck and experience the flow of the higher water fall.

1. Main Body: Shall be constructed of stainless steel structural tubing 2.375" (60.3mm) in diameter with a wall thickness of 0.120" (3 mm). A stainless steel sphere and a machined stainless steel static joint shall be welded to the main body.
2. Nozzle: Two (2) narrow openings 6.875" (175mm) long machined on the main body of the feature create both water effects. Openings shall be machined on opposite sides of the main body with at an angle from horizontal creating one higher and one lower water fall.
3. Hardware: All hardware shall be constructed of 316/316L marine grade stainless steel.
4. Hydraulic: The hydraulic requirement shall be 25-30 gpm (94.6-113.6 lpm) @ 5 PSI (0.3bar).

d. **Deck Geysers (2):** Consist of a combination of two floor geysers. The Geysers consist of 6 holes water jets installed through the deck openings and shooting vertical. The Geysers shall be hydraulically linked together in order to create interaction between the two geyser units.

1. Main body: Shall be constructed of a solid machined UHMW body.
2. Hardware: All hardware shall be constructed of 316/316L marine grade stainless steel.
3. Hydraulic: The hydraulic requirements shall be 5-10 gpm total @ 5-10 psi.

e. **Water flower:** Overhead water feature consisting of a flower shaped translucent disk with a bubbling water spray on top producing a raining water and acoustic effect. Four dancing ribbons of water are channeled out of the flower shape.

1. Flower shape: Shall be constructed of a 30" (762 mm) diameter, colored (specified), translucent SeeflowTM Polymer shape installed top of a structural vertical post.
2. Spray cap: Shall consist water effect bubbling from a 6-holes soft stream nozzle made of molded high density polyurethane located on top of the Seeflow™ Polymer flower.
3. Hardware: All hardware shall be constructed of 316/316L marine grade stainless steel.
4. Hydraulic: The hydraulic requirements shall be 30-40 gpm @ 5-10 psi.

6. WATERSLIDES - BODY SLIDES

a. **Slides:** Slides shall be designed with safety, comfort and long lasting durability in mind. Slides shall be available in different deck heights and/or configurations to provide various sliding experience for different age groups. Sliding experiences can vary from fast & thrilling, racing, oscillating, darkness & daylight, black hole, etc. according to slide type. Colors shall be selected by Owner from all standard colors provided by the manufacturer (minimum of 14 color choices). Slides shall include the following components: Safety cross bar at slide entrance, Lateral safety panels (if applicable) or raised sidewalls at the start section, Water feed hardware with adjustable ball valve, Slide exit support and anchors and Safety net skirting (if applicable).

b. **Kiddie Slide:** Slide shall be designed for kids with discovery and fun in mind. Slide configuration shall be straight single track or multiple tracks kids slide, made of one piece to minimize number of joints and provide the safest and most comfortable ride. Maximum

inclination of sliding surface shall be 27 to 31 degrees from horizontal, providing excitement for kids of all ages. Kiddie Slide cross section shall have 22.125" (562 mm) wide interior flat bottom shape with 8" (203 mm) high sides and rounded edges. Total width of slide part shall be 31.5" (800 mm). Water flow range shall be from 10 to 30 gpm (38 to 114 lpm) depending on the slide exit type. Specific slide length, deck height, average inclination, exit type and water flow shall be shown on the drawings

c. Landing Mat exit: Consisting of one or multiple safety foam mat(s), installed on the pool bottom, located after the exit of the slide. The Landing Mat Exit shall provide a safe deceleration zone for the rider, when entering the splash pool. Mat shall be constructed of closed cell EVA foam including UV inhibitor and especially made for chlorinated water environment. Landing mat shall be permanently installed on pool bottom as per manufacturer's recommendations

d. Support posts and Slide deck supports: Shall be type 304/304L stainless steel with a protective coating. Support posts shall include a flange for mounting on the floor or on a column.

e. Flume joints and Hardware: Flume to flume and flume to support joints shall be fastened using 3/8" ASTM appropriate grade marked 316/316L stainless steel corrosion resistant bolts, washers and nuts. Flume joints shall be made using waterslide approved caulking. All secondary assembly or connections shall be made using 316/316L stainless steel corrosion resistant hardware.

7. SAFETY AND CRAFTSMANSHIP

a. All exposed edges of play products shall be machined to a rounded edge.
b. All welds shall be grinded, polished, watertight, and factory pressure tested.
c. Nozzles and Spray heads shall be recessed, flat or rounded to provide no protrusion hazard.
d. All assembly and interactive play components shall be designed and built to ensure a completely safe play environment with no pinch point, entrapment or protrusion hazard.
e. All accessible posts and support posts shall have rubber material Toe Guards installed and covering the anchoring assembly hardware from pinch points and protrusions.
f. All products shall be designed in accordance with the latest ASTM and EN standards for aquatic play equipment.

2.20 POOL COVERS

A. The swimming pool cover system must be the standard catalogued product of a company regularly engaged in the manufacture of such products. Alternate swimming pool cover systems are not considered unless equal to the specified product and must be submitted for approval not less than ten (10) days prior to bid date. Submittal data must include complete documentation relating to the specified features and include manufacturer's sales literature, specification sheets, energy conservation audit, installation/maintenance manuals and engineering drawings.

B. The swimming pool cover system must be of the energy conservation type. The covers must be supplied in panel sections, allowing for ease of storage, and ease of installation and removal. The cover panel materials must withstand the commercial aquatic facility's environment. Panels must receive edging materials to strengthen the panel and to allow for deployment and retrieval without damaging the panel's main body materials. Materials must be ultraviolet stabilized to ensure long life. The cover panels must be reversible, allowing for the panels must be rotated, using both sides and end to end, every other year, supporting additional panel life. Warning labels must be affixed in four places to both sides of the panel and must instruct in the panels proper use and warn patrons of hazards associated with covered swimming pools. Cover panel systems must be supplied with a protector, for use when panels are not deployed.

C. Basis of Design: The swimming pool cover system and its accessory items must be Thermal-King by Spectrum Aquatics, Energy Saver by SR Smith (formally T- Star Enterprises), Commercial Pool Cover by Alta Enterprises or approved equal.

D. The swimming pool cover for the competition pool must completely cover the pool surface. The swimming pool cover for the leisure pool will need to custom with the understanding that the cover will not include the zero entry – pool feature area. The leisure pool cover should cover the pool from the depths of 1'-0" to 5'-0" .

E. Cover Material

1. Material must be woven, twelve by twelve count per inch, high-density polyethylene, ultraviolet stabilized film fabric, flame laminated to both sides of a 1/8-inch thick, closed cell, medium density, white, polyethylene foam. The woven polyethylene film fabric must be coated on the exposed sides with an ultraviolet stabilized, chemically resistant polyethylene coating. The combination of film, foam and woven components must be non-toxic, non-absorbent, non-permeable and buoyant. Color must be blue on upper surface and on under surface. In addition to the above, cover must meet the following requirements:

2. Cover Design Criteria

    a. Cover panels must be divided into widths suitable for convenient daily use (removal and deployment), totally covering the surface of the swimming pool without gaps or overlaps. Cover panels must be compatible for use with storage reel(s) and not exceed a width equal to one foot less than the length of the storage reel winding tube on which it must be stored.

3. Edging

    a. Protective-reinforcement edging must be installed along ends and sides of each panel. A weighted non-metallic/non-corroding material must be sewn into the panel protective edging. The weighted edge must be flat and must conform to the shape of the cover. Cover end edges must be reinforced with a double layer of polyethylene-coated film fabric. The end edging must be designed, in such a manner as, to prevent panels from diving when they are being pulled across the surface of the swimming pool. The encapsulated weighted edging must be wrapped around the cover corners. The entire corner construction must be reinforced with a 1/8-inch-thick load dispersion plate. Both ends of each cover panel must be equipped with no less than three (3) non-corrosive/metallic grommets and quick-release loops for easy connection to a storage reel or to the next cover panel.

4. Sewing

    a. Sewing must be double locking chain stitch, using ultraviolet stabilized, chemically resistant, 100% polyester thread. Main body seams must be double overlap parallel double chain lock stitched. No butt, welded, glued, or heat-sealed seams will be employed. Sewing must be accomplished with computer-controlled machines, synchronizing speed with stitch length to assure uniformity and strength.

5. Warning Labels

    a. Warning labels consistent with the recommendations of the Federal Consumer Protection Agency must be permanently affixed to each end of each cover panel and to the sides of perimeter panels on both side of the panel.

F. Portable Storage Reel

1. The portable storage reel assembly must be provided in the size and quantity to store all pool cover sections. Portage storage reel assembly must be the Bitterroot by Spectrum Aquatics, the Manual Storage Reel by SR Smith, the Deck Reel System by Alta Enterprises or approved equal. The winder must be provided with a cover to protect the pool covers while stored.

2.21 GEOTHERMAL POOL HEATING SYSTEMS

A. Provide the geothermal pool water heating systems for the Competition Pool and the Leisure Pool. The geothermal heating systems to include an intake well, discharge well, well pump and controls, piping, geothermal pool heaters, controls, gauges, thermostats, control valves and wiring required to draw water from the intake well, heat the pool water, and return it back to the discharge well.

B. Provide the heat pump units identified in the heater schedule located on the pool drawings along with all items listed above.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS, INSPECTION AND PREPARATION

A. Carefully examine of the contract documents for requirements that affect the work of this section. Prior to starting work, notify the General Contractor of defects requiring correction. Do not start work until conditions are satisfactory.

B. Verify that work by others, related to this section, has been completed. This includes earthwork, concrete work, and mechanical, electrical, and plumbing connections.

C. Protect materials and work completed by others from damage while completing the work in this section.

3.02 FIELD MEASUREMENTS

A. Verify benchmark and pool location prior to layout.

B. If field measurements differ from the construction drawing dimensions, notification must be given to the Architect prior to proceeding with work.

3.03 EXCAVATION, REINFORCING STEEL AND SWIMMING POOL PNEUMATICALLY APPLIED OR CAST-IN-PLACE CONCRETE

A. Reference Division 31 - Earthwork

B. Reference Division 3 - Concrete

C. Reference Section 131102 – Swimming Pool Pneumatically Applied Concrete

D. Reference Section 131101 – Swimming Pool Cast-In-Place Concrete

3.04 TOLERANCES FOR CONSTRUCTION OF THE POOL SHELL

A. The completed structures must be constructed level and to the dimensions, elevation, depths, and thickness as shown on the plans.

B. The elevation tolerance of the pool shell and gutter lip must be plus or minus 1/8 inch.

C. The vertical wall surface tolerance of the pool shell, for the first 36 inches from the water surface must be plus or minus 1/4 inch from plumb measured with a 6-foot straight edge.

D. For competitive racecourses, the following pool shell tolerances must apply:

Course	Tolerance	Minimum	Maximum
25 Yard	+ 1 3/16” /- 0”	75’ – 3/4”	75’ – 1 15/16”

1. The above dimensions include allowances for a touchpad at each end of the course. The maximum dimension includes the construction tolerance. These above tolerances also apply to courses utilizing moveable bulkhead(s).

2. The above dimensions apply to a vertical plane extending 1’-0” above and 3’-0” below the surface of the water at points of both end walls.

E. Provide the services of a registered engineer or land surveyor who must measure and certify the elevations of the gutter lip at 10-foot centers as well as the length of each lane for each possible racing course. Courses designed with touchpads for competition must be measured and certified with touchpads in place. Course length survey must be made with the pool filled with water between 78- and 82-degrees Fahrenheit. Forms for the lane measurements are available from USA Swimming (719-866-4578) and must be submitted for record.

F. Ground wires or grade pins, if used, must be installed in such a manner that they accurately outline the section of the pool shell as indicated on the plans. They must be located at intervals sufficient to ensure proper thickness throughout and must be maintained tight. Grade pins or grounding wires must not be permanently embedded in the pool shell.

3.05 WATER TIGHTNESS TEST

A. This test applies to the pool(s), the surge tank(s), and the gutter system(s). The water tightness test shall be completed prior to the application of the pool finish.

B. Water Tightness Test Procedure

1. Preparation

a. Allow the concrete structure to set 28 days for curing purposes. Once the pool shell has gained sufficient strength to withstand the test load and after all the outlets have been securely sealed, the pool shall be filled with water.

2. Fill: Fill and then isolate the pool(s), the surge tank(s), and the gutter system(s). The water tightness test shall begin after the vessel has been filled for a minimum of three (3) days. During the filling, all outlets shall be monitored for water tightness and all concrete joints shall be monitored for any visible leakage. If any visible leakage from the vessel is observed, the condition shall be corrected prior to the start of the test.

a. After the initial fill, all ground water shall be removed from the pool sight sump or the pool location de-watering system. This shall be completed prior to the start of the water tightness test. De-watering of the pool sight sump shall be maintained during the entire duration of the test.

3. Evaporation/Precipitation Measurement Procedure

a. Fill a floating, restrained, partially filled, calibrated, open container with water and allow the container to float within the pool during the testing period. This will be used to measure evaporation and precipitation.

4. Measurement

a. On a separate sheet of paper draw a sketch of the pool. Measurements shall be taken at the pool(s), the surge tank(s), and the gutter system(s). Multiple test points with averaging are recommended for vessels which will be exposed to wind. Document the separate findings on the chart below. Repeat the measurements and document every 12 hours for a total of three (3) days. The General Contractor shall check the pool(s), the surge tank(s), and the gutter system(s) for water loss with the Architect or Owner's representative every 12 hours.

Total Allowable Water Loss:	Total Gallons:	_____	(0.1%) x 0.001 = _____	Allowable Loss	Pan Depth Per 24 Hrs.

Pool Measurements	_____ Pool	Gutter System	Surge Tank		Pan Measurements
12 Hrs.					
24 Hrs.					
36 Hrs.					
48 Hrs.					
60 Hrs.					
72 Hrs.					

5. Total Loss = 7.481 x Structure Surface Area (SF) x Total Water Loss per Day (FT) – Evaporation per Day (FT) + Precipitation per Day (FT)

   a. Day #1 =

   b. Day #2 =

   c. Day #3 =

6. Repair

   a. The allowable leakage rate for an unlined pool structure shall not exceed 0.1 percent of the total water volume in a 24-hour period. (Example: 0.001 x 200,000 gallon pool = 200 gallons per 24 hour period.) This excludes the loss/addition of evaporation/precipitation.

7. Absorption

   a. Waiting 3 days after the initial water fill will allow the concrete to absorb water and shall be sufficient to minimize the effect of absorption on the test results.

8. Evaporation

   a. Evaporation shall not have a significant effect on natatoria that are completely enclosed with no air circulation during the water tightness test. However, evaporation will have a significant effect on the water level in natatoria that has air movement across the water surface or are still partially uncovered.

9. If leaks are detected, repair the vessel and make water tight in accordance with these requirements.

10. With regard to this test, the curing requirements, the final fill and the cost of the water for two (2) complete fillings shall be borne by the Owner. Any subsequent fillings or partial fillings (more than 25%) of the pool shall be by the CONTRACTOR, at its own expense.

3.06 PIPING INSTALLATION

A. General

1. Provide and erect, according to the best practices of the trade, piping shown on the drawings and required for the complete installation of these systems. The piping shown on the drawings must be considered as diagrammatic in indicating the general run and connections and may or may not in parts be shown in its true position. The piping may have to offset, lowered, or raised as required or as directed at the site. This does not relieve responsibility for the proper erection of the systems or piping in every respect suitable for the work intended as described in the specifications and approved by the Architect. In the erection of piping, it must be properly supported, and proper provisions must be made for expansion, contraction and anchoring of piping. Piping must be cut accurately

for fabrication to measurements established at the construction site. Pipe must be worked into place without springing and/or forcing, properly clearing windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate installation will not be permitted. Pipes must have burrs and/or cutting slag removed by reaming or other cleaning methods in strict accordance with the manufacturer's instructions. Changes in direction must be made with fittings. Open ends of pipes and equipment must be properly capped or plugged to keep dirt and other foreign materials out of the systems. Plugs of rags, wool, cotton waste or similar materials will not be used in plugging. Piping must be arranged so as not to interfere with removal and maintenance of equipment, filters, or devices, and so as not to block access to manholes, access openings, etc. Flanges or unions as applicable for the type of piping specified must be provided in the piping at connections to items of equipment. Piping must be installed to ensure noiseless circulation. Valves and specialties must be so placed to permit easy operation and access.

B. Pipe Hangers and Supports

1. Pipes must be adequately supported by pipe hangers and supports as specified.

2. Horizontal PVC Schedule 80 piping must be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 120-degree F and as listed below:

Nominal Pipe Size	Hanger Support Spacing	Minimum Rod Size for Single Rod Hanger
1-1/4" and less	5'-0"	3/8"
1-1/2" to 3"	6'-0"	1/2"
4" to 6"	8'-0"	5/8"
8" to 12"	10'-0"	7/8"
Greater than 12"	12'-0"	1"

3. Horizontal CPVC Schedule 80 piping must be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 140-degree F and as listed below:

Nominal Pipe Size	Hanger Support Spacing	Minimum Rod Size for Single Rod Hanger
½" and less *	4'-0"	3/8"
¾" to 2"	6'-0"	3/8"
2-1/2" to 3"	7'-0"	1/2"
4" to 8"	8'-0"	7/8"
Greater than 12"	10'-0"	1"

4. Round rods supporting the pipe hangers must be of the following dimensions:

Nominal Pipe Size	Rod Diameter
1/2" to 2" pipe	-3/8" rod
2-1/2" to 3" pipe	-1/2" rod
4" to 5" pipe	-5/8" rod
6" pipe	-3/4" rod

5. Hanger rods must be galvanized steel. Provide for controlling level and slope by turn buckles or other approved means of adjustment and incorporate lock nuts.

6. Provide means of preventing dissimilar metal contact such as plastic-coated hangers, copper colored epoxy paint, or non-adhesive isolation tape.

7. Provide hangers to provide a minimum of 1-inch space between finished covering and adjacent work.

8. Place a hanger within 12 inches of each horizontal elbow.

9. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.

10. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified. Trapeze hangers must be spaced according to the smallest pipe size or provide intermediate supports according to the support spacing schedules. Provide heavier members as required for the load supported for the entire span distance. Hanger rods must be as specified above and properly sized for the load supported, but not less than 5/8 inches diameter.

11. Piping must be rigidly supported from the building structure by means of hanger assemblies properly selected and sized for the application in accordance with the manufacturer's recommendations and specifications. Do not support piping from other pipes, ductwork or other equipment that is not building structure. Do not modify building structure for hanger installation.

12. Attachment of piping hangers to the building structure must be provided in a manner approved by the Architect. Provide concrete inserts installed by the General Contractor in the building construction at the time the concrete is poured, and hangers must be attached to these inserts.

13. The use of pipe hooks, chains, or perforated iron for pipe hanger supports will not be permitted.

14. A design for piping in a service tunnel, if required, supported by a structure must be submitted for approval. The structure must be non-corrodible and must be of a size and configuration to rigidly support the piping as shown in the plans at a minimum spacing as shown below.

C. Concrete Inserts

1. Provide inserts for placement in form work before concrete is poured.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Where concrete slabs form finished ceilings, provide inserts must be flush with the slab surface.

4. Provide hook rods to concrete reinforcement section for inserts carrying pipe over 4 inches.

D. Piping Installation – Below Grade

1. Trench bottoms must be smooth and free of rocks and debris. If the trench is dug in ledge rock, hardpan or where large boulders are not removed, place 3 inches of sand or compacted fine-grained soil below pipe. Pipe must be supported over its entire length with firm, stable material. Blocking will not be used to change pipe grade or provide intermittent support over low sections in the trench. Surround the pipe with backfill meeting the requirements of Section 02200 or 312000 with a particle size of 1-1/2 inch or less and in accordance with the project geotechnical report. Compact in layers not to exceed 6 inches with vibratory method. Follow installation methods of ASTM D2774 "Underground Installation of Thermoplastic Pressure Piping".

E. Flushing, Draining and Cleaning Pipe Systems

1. Flush out water systems with water before placing them in operation. Other systems must be cleaned by using compressed air or nitrogen. After systems are in operation and during the test period, strainer screens must be removed and thoroughly cleaned.

F. Expansion and Contraction

1. Make necessary provisions for expansion and contraction of piping with offsets, loops, flexible connections, and anchors as required to prevent undue strain. Provide shop drawings for method and arrangement for control of expansion and contraction of piping.

G. Testing

1. Piping installation and pressure testing must be reviewed by the Owner’s testing agency before commencement of backfilling. A minimum notice of one (1) week is required prior to review. Results of review must be documented.

2. Pool related piping must be hydraulically pressure tested (with water, not air) to a pressure of not less than 50 PSI for a period of no less than two (2) hours.

3. Maintain a sustained 20 PSI pressure on pool related piping throughout the course of construction.

4. Adhere to the applicable provisions of Division 15 or 22 - Mechanical/Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.

3.07 EQUIPMENT AND SYSTEMS INSTALLATION

A. Provide and assemble equipment, special parts and accessories as shown on pool drawings, specifications, and shop drawings of the equipment suppliers.

B. Provide anchors and inserts imbedded in the deck including fittings, inserts and structure sleeves and required anchorage as shown on the plans and as indicated in this section of the specifications. Equipment must be set true and plumb, using factory jigs where available. Removable equipment items must be easily removable from anchors and must fit without noticeable wobble.

C. Provide templates for equipment anchors. Provide anchor bolts of the size and spacing as required by the equipment manufacturer. Anchor bolts must be stainless-steel Type 316L and of a length capable of adequate anchorage into rough slab-on-grade allowing for finish deck tile and setting bed. Anchors must be set and cast into place during building concrete work. Inspect anchor settings for horizontal and vertical alignment prior to placing concrete.

D. Provide equipment and systems in accordance with manufacturer's directions. Equipment must be assembled and in place for final observation.

E. Items necessary to complete this section are shown on the plans or described in the specifications including items that may be purchased by the Owner. Items are detailed and specified as a guide for dimensional purposes. Make provisions accordingly and submit shop drawings and submittals based on that data.

3.08 START-UP AND INSTRUCTION

A. Supply the services of an experienced swimming pool operator/instructor for a period of not less than two days (total 16 hours) after the pool(s) have been filled and initially placed in operation. During this period, the Owner's representatives who will be operating the pool(s) must be thoroughly instructed in phases of the pool's operation. Deliver six (6) complete sets of operating and maintenance instructions for the swimming pool, structures, finishes and component equipment. Prior to leaving the job, obtain written certification from the designated Owner's representative acknowledging that the instruction period has been completed and necessary operating information provided. Include the cost of two (2) additional days (total 16 hours) of instruction and operational check out by the qualified representative during the first season of operation.

B. Written reports of each of these visits outlining the pool's operation, competence and performance of the pool's operation personnel, and other pertinent comments must be submitted to the Owner and Architect/Engineer within one (1) week after each visit.

C. Provide specific written procedures that must be followed for emptying and refilling the pool as mentioned previously in this section. The procedures must be included in the bound volume of operating instructions and references in the front index with a note headed by the words: "CAUTION -- VERY IMPORTANT".

END OF SECTION 131100

SECTION 131101 - SWIMMING POOL 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. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:

1. Swimming pool:
   a. Bottom slab.
   b. Walls
   c. Miscellaneous features, slabs on grade and all other elements.

B. Related Requirements:

1. Division 03 for all concrete not related to swimming pool construction.
2. Division 03 or Division 13 for water tightness testing.
3. Section 131102 “Swimming Pool Shotcrete”. Shotcrete may be substituted for swimming pool cast-in-place walls.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with 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.
   e. Special Pool finish 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, and joint-filler strips, forms and form removal limitations, anchor rod and anchorage device installation tolerances if required for equipment installation, under slab pipe encasement requirements, and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

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

C. 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.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1.Location of construction joints is subject to approval of the Engineer.

E. Samples: For waterstops.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Waterstops.
6. Curing compounds.
7. Bonding agents.
8. Joint-filler strips, if required.
9. Repair materials.
10. Dowel bar substitutes.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:

1. Maintain concrete temperature below 95 deg F (35 deg C) at time of placement. 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. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).
2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
   a. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Void Forms (if indicated on drawings): Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

2.4REINFORCEMENT ACCESSORIES

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

1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

B. Dowel Bar Substitutes: Tapered, threaded couplers, pre-assembled to reinforcing with mounting plate for attachment to form work and a pressed in metal disc thread protector which can be easily removed. The mechanical connection shall meet building code requirements of developing in tension or compression. The mechanical connection shall be the positive locking, taper threaded type coupler manufactured from high quality steel. The bar ends must be taper threaded using the manufacturer’s requirements.

1. Lenton Form Saver; Erico Corp.

2.5CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do 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.

F. Water: ASTM C 94/C 94M and potable.

2.6 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Sika Greenstreak.
   b. Vinylex Waterstop & Accessories.
2. Profile: Ribbed without center bulb, non-tapered.
3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick); nontapered.

B. Non-Expanding Plastic Adhesive Waterstops: Manufactured rectangular or trapezoidal strip, single-component, self-sealing adhesive compound, for adhesive bonding to concrete, 5/8 by 1-1/2 inch.

1. Products: Subject to compliance with requirements, provide the following:
   a. Synko-Flex SF302, Henry Company.
      1) Synko-Flex SF311 Solvent Based Primer.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. BASF Corporation-Construction Systems; Confilm.
   b. ChemMasters, Inc; Spray-Film.
   c. Dayton Superior; AquaFilm J74RTU.
   d. Euclid Chemical Company (The); an RPM company; Eucobar.
   e. L&M Construction Chemicals, Inc; E-CON.
   f. Metalcrete Industries; Waterhold.
   g. Sika Corporation; Caltexol CIMFILM.
   h. TK Products; TK-2120 TRI-FILM.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of pool finish.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
   a. BASF Corporation-Construction Systems; MasterKure CC 200 WB (Pre-2014: Kure-N-Seal W).
   b. Dayton Superior; Cure & Seal 1315 J22 WB.
   c. Euclid Chemical Company (The); an RPM company; Diamond Clear VOX.
   d. L&M Construction Chemicals, Inc; Dress & Seal WB.
   e. SpecChem, LLC; Cure & Seal WB 25.
   f. W.R. Meadows, Inc; Vocomp-20.

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

1.Provide for cast-in-place concrete coping.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Dayton Superior Corporation; Conspec Strong Bond.
    b. Euclid Chemical Company (The), an RPM company; Flex-Con.
    c. W. R. Meadows, Inc.; Sealtight Acry-Lok.
    d. Kaufman Products, Inc.; Surebond.

2.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.
    a. Xypex Concentrate.
2. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
3. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
5. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.
    a. Xypex Concentrate.
2. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
3. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
5. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.10 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 (ACI 301M).

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

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

1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete and concrete with a w/c ratio below 0.50.

2.11 CONCRETE MIXTURES FOR SWIMMING POOL ELEMENTS

A. Slabs, Walls, Coping and Other Elements: Normal-weight concrete.

1. Minimum Compressive Strength: 4500 psi (31.0 MPa) at 28 days.
2. Maximum W/C Ratio: 0.42.
3. Minimum Cement Content: 600 lb/cu. yd.
4. Slump Limit: 4 inches (100 mm), 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.14 DRAINAGE FILL

A. Drainage Course under bottom slabs: Narrowly graded mixture of frost-free, washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

PART 3 EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
   2. Class D, 1 inch (25 mm) for rough-formed finished surfaces.
D. Construct forms tight enough to prevent loss of concrete mortar.
E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.
F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
H. Chamfer exterior corners and edges of permanently exposed concrete.
   1. Comply with pool and gutter profile shown if edges not shown to be chamfered.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. If required for equipment or piping installation, install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.

1.Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 STEEL REINFORCEMENT INSTALLATION

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Dowel bar substitutes may be used in lieu of lap splices.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams and slabs in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of slabs and beams.
5. Vertical joints in walls shall be located at corners, and in concealed locations where possible.
6. Use a bonding agent:
   a. At locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   b. At cove joint where cove mortar is placed against hardened wall and slab.
   c. At coping where coping is placed against hardened wall.

C. Contraction Joints in Slabs: No contraction joints shall be placed in pool bottom slab.

D. Joints in Coping:

1. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated, or, 2 feet maximum. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   b. Isolation Joints: Install vertical joint-filler strips at _ feet.
      1) Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants are indicated.

3.7 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Non-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING SLABS AND WALLS

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

B. Verify all finish requirements with swimming pool finish subcontractor before finishing concrete.

1. Provide certification, with swimming pool finish subcontractor, that concrete finish complies with manufacturer’s recommendations for final pool finish.

C. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.

1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.

D. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

E. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with ceramic tile, paint, or another thin-film-finish coating system.

2. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. 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.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place

patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:

1. Steel reinforcement placement.
2. Headed bolts (if required for equipment and piping installation).
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

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

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
   a. When frequency of testing provides 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/C 143M; one test at point of placement 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. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete;one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
8. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 131101

SECTION 131102 - SWIMMING POOL SHOTCRETE

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 shotcrete applied by dry-mix or wet-mix process for the following:
   1. Swimming pool walls.

B. Related Sections include the following:
   1. Division 13 Section “Swimming Pools” for pool shell tolerances and other items.
   2. Division 13 Section “Swimming Pool Cast In Place Concrete” for pool bottom slabs and other pool-related structures.
   3. Division 13 Section “Swimming Pool Cast In Place Concrete” for pool coping.
   4. Division 03 or Division 13 for water tightness testing.

1.3 DEFINITIONS

A. Shotcrete: Mortar or concrete pneumatically projected onto a surface at high velocity.
B. Dry-Mix Shotcrete: Shotcrete with most of the mixing water added at nozzle.
C. Wet-Mix Shotcrete: Shotcrete with ingredients, including mixing water, mixed before introduction into delivery hose.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5ACTION SUBMITTALS

A. Product Data: For each type of product including reinforcement and forming accessories, shotcrete materials, admixtures, and curing compounds.

B. Design Mixtures: For each shotcrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. For predampened dry-mix mixtures, indicate amounts of mixing water to be added to the dry-mix materials before mixing and conveying through the delivery hose.

C. Shop Drawings: For shotcrete installation. Include support and anchor details; reinforcement materials and grades and details of fabricating, bending, and placing reinforcement; number and location of splices; special reinforcement required for openings through shotcrete structures; formwork materials and details of formwork fabrication, assembly, and support; and locations of proposed construction joints.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials.

C. Preconstruction Test Reports: For shotcrete.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer employing nozzle operators for the Project, each of whom attains mean core grades not exceeding 2.5, according to ACI 506.2, on preconstruction tests, is ACI Shotcrete Nozzleman certified in Dry-Mix Process for Vertical Position, is ACI Shotcrete

Nozzleman certified in Wet-Mix Process for Vertical Position as appropriate to the required shotcrete work.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. ACI Publications: Comply with ACI 506.2, "Specification for Shotcrete," unless modified by requirements in the Contract Documents.

D. Shotcrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design shotcrete mixtures.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing and inspections indicated below:

1. Produce shotcrete test panels before shotcrete placement according to requirements in ACI 506.2 and ASTM C 1140 for each design mixture, shooting orientation, and nozzle operator. Produce test panels with dimensions of 24 by 24 inches (600 by 600 mm) minimum and of average thickness of shotcrete, but not less than 3-1/2 inches (90 mm).

2. From each test panel, testing agency will obtain six test specimens: one set of three specimens unreinforced and one set of three specimens reinforced. Agency will perform the following:

a. Strength Testing: Test each set of unreinforced specimens for compressive strength according to ASTM C 42/C 42M.

b. Core Grading: Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Forms: Form-facing panels that will provide continuous, straight, smooth, concrete surfaces. Furnish panels in largest practical sizes to minimize number of joints.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufactured according to CRSI's "Manual of Standard Practice" and as follows:

1. For uncoated reinforcement, use all-plastic bar supports.

C. Reinforcing Anchors: ASTM A 36/A 36M, unheaded rods or ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), hex-head bolts; carbon steel; and carbon-steel nuts.

1. Finish: Plain, uncoated.

2.3 SHOTCRETE MATERIALS

A. Source Limitations for Shotcrete: Obtain each color, size, type, and variety of shotcrete material and shotcrete mixture from single manufacturer with resources to provide shotcrete of consistent quality in appearance and physical properties.

B. Portland Cement: ASTM C 150, Type I or Type III. Use only one brand and type of cement for Project.

1. Fly Ash: ASTM C 618, Class C or Class F.

C. Normal-Weight Aggregates: ASTM C 33, from a single source, and as follows:

1. Combined Aggregate Size: ACI 506R or ASTM C 1436, Grading No. 2 sieve analysis.

D. Water: Potable, complying with ASTM C 94/C 94M, free from deleterious materials that may affect color stability, setting, or strength of shotcrete.

E. Ground Wire: High-strength steel wire, 0.8 to 1.0 mm in diameter.

F. Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.4ADMIXTURES

A. General: ASTM C 1141, Class A (liquid) or Class B (non-liquid), but limited to the following admixture materials. Provide admixtures for shotcrete that contain not more than 0.1 percent chloride ions. Certify compatibility of admixtures with each other and with other cementitious materials.
   1. Accelerating Admixture, Conventional: ASTM C 494/C 494M, Type C or Type E.
   2. Pozzolanic Admixture: Fly ash, ground granulated blast-furnace slag, and silica fume as limited in "Shotcrete Materials" Article.
   3. Coloring Admixture: Coloring agent as limited in "Shotcrete Materials" Article.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry, or cotton mats.
B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
C. Water: Potable.
D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 SHOTCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of shotcrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 506.2.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based laboratory trial mixture or field test data, or both.
B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
C. Cementitious Materials: Limit use of fly ash to not exceed, in combination, 15 percent of portland cement by weight.
D. Limit water-soluble chloride ions to maximum percentage by weight of cement or cementitious materials permitted by ACI 301.
E. Admixtures: When included in shotcrete design mixtures, use admixtures according to manufacturer's written instructions.
F. Design-Mixture Adjustments: Subject to compliance with requirements, shotcrete design-mixture adjustments may be proposed when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.7 SHOTCRETE MIXTURES

A. Shotcrete Mixture: Proportion mixture to provide shotcrete with the following properties:
   1. Compressive Strength (28 Days): 4500 psi (31.0 MPa).
   2. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight wet-mix shotcrete having an air content before pumping of 8 percent with a tolerance of plus or minus 1-1/2 percent.

2.8 SHOTCRETE EQUIPMENT

A. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.
B. Dry-Mix Delivery Equipment: Capable of discharging aggregate-cement mixture into delivery hose under close control and maintaining continuous stream of uniformly mixed materials at required velocity to discharge nozzle. Equip discharge nozzle with manually operated water-injection system for directing even distribution of water to aggregate-cement mixture.
   1. Provide uniform, steady supply of clean, compressed air to maintain constant nozzle velocity while simultaneously operating blow pipe for cleaning away rebound.

2. Provide water supply with uniform pressure at discharge nozzle to ensure uniform mixing with aggregate-cement mix. Provide water pump to system if line water pressure is inadequate.

C. Wet-Mix Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

2.9 BATCHING AND MIXING

A. Dry-Mix Process: Measure mixture proportions by weight batching according to ASTM C 94/C 94M or by volume batching complying with ASTM C 685/C 685M requirements.
1. In volume batching, adjust fine-aggregate volume for bulking. Test fine-aggregate moisture content at least once daily to determine extent of bulking.
2. Prepackaged shotcrete materials may be used at Contractor's option. Predampen prepackaged shotcrete materials and mix before use.

B. Wet-Mix Process: Measure, batch, mix, and deliver shotcrete according to ASTM C 94/C 94M and furnish batch ticket information.
1. Comply with ASTM C 685/C 685M when shotcrete ingredients are delivered dry and proportioned and mixed on-site.

2.10 RELATED MATERIALS

A. Latex Bonding Agent: ASTM C 1059/C 1059M, Type II.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following;
a.Latex Bonding Agent, Type II (Non-Redispersible):
1) Dayton Superior Corporation; Conspec Strong Bond.
2) Euclid Chemical Company (The), an RPM company; Flex-Con.
3) W. R. Meadows, Inc.; Sealtight Acry-Lok.
4) Kaufman Products, Inc.; Surebond

2.11 REPAIR MATERIALS

A. Concrete Patching Mortar: Chemical treatment for waterproofing concrete.
1.Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.
a.Xypex Concentrate.

2.12 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
1. Available Manufacturers:
a. Bometals, Inc.
b. Greenstreak.
c. Meadows, W. R., Inc.
d. Murphy, Paul Plastics Co.
e. Progress Unlimited, Inc.
f. Tamms Industries, Inc.
g. Vinylex Corp.
2. Profile: Ribbed without center bulb.
3. Dimensions: 4 inches by 3/16 inch thick (150 mm by 10 mm thick); nontapered.

B. Non-Expanding Plastic Adhesive Waterstops: Manufactured rectangular or trapezoidal strip, single-component, self-sealing adhesive compound, for adhesive bonding to concrete, 5/8 by 1-1/2 inch.
1. Products: Subject to compliance with requirements, provide the following:
a. Synko-Flex SF302, Henry Company.
1) Synko-Flex SF311 Solvent Based Primer.

2.13 DRAINAGE FILL

A. Drainage Course under bottom slabs: Narrowly graded mixture of frost-free, washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

PART 3 EXECUTION

3.1 PREPARATION

A. Concrete: Before applying shotcrete, remove unsound or loose materials and contaminants that may inhibit shotcrete bonding. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces to saturated, surface-dry condition before shotcreting.
   1. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper shotcrete bonding.

B. Earth: Compact and trim to line and grade before placing shotcrete. Do not place shotcrete on frozen surfaces. Dampen surfaces to saturated, surface-dry condition before shotcreting.

C. Rock: Clean rock surfaces of loose materials, mud, and other foreign matter that might weaken shotcrete bonding. Dampen surfaces to saturated, surface-dry condition before shotcreting.

D. Steel: Clean steel surfaces by abrasive blasting according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

3.2 FORMS

A. General: Design, erect, support, brace, and maintain forms, according to ACI 301, to support shotcrete and construction loads and to facilitate shotcreting. Construct forms so shotcrete members and structures are secured to prevent excessive vibration or deflection during shotcreting.
   1. Fabricate forms to be readily removable without impact, shock, or damage to shotcrete surfaces and adjacent materials.
   2. Construct forms to required sizes, shapes, lines, and dimensions using ground wires and depth gages to obtain accurate alignment, location, and grades in finished structures. Construct forms to prevent mortar leakage but permit escape of air and rebound during shotcreting. Provide for openings, offsets, blocking, screeds, anchorages, inserts, and other features required in the Work.

B. Form openings, chases, recesses, bulkheads, keyways, and screeds in formwork. Determine sizes and locations from trades providing such items. Accurately place and securely support items built into forms.

3.3 STEEL REINFORCEMENT

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that weaken shotcrete bonding.

C. Securely embed reinforcing anchors into existing substrates, located as required.

D. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports, bolsters, chairs, spacers, and other devices as required to maintain minimum concrete cover.

E. Set wire ties with ends directed into shotcrete, not toward exposed shotcrete surfaces.

3.4 WATERSTOPS

A. Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions. Prevent displacement during shotcrete application.

3.5 JOINTS

A. General: Construct joints at locations indicated or as approved by Architect.
B. Construction Joints: Locate and install construction joints tapered to a 1:1 slope where joint is not subject to compression loads and square where joint is perpendicular to main reinforcement. Continue reinforcement through construction joints unless otherwise indicated.

3.6 ALIGNMENT CONTROL

A. Ground Wires: Install ground wires to establish thickness and planes of shotcrete surfaces. Install ground wires at corners and offsets not established by forms. Pull ground wires taut and position adjustment devices to permit additional tightening.

3.7 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by shotcrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.8 APPLICATION

A. Apply temporary protective coverings and protect adjacent surfaces against deposit of rebound and overspray or impact from nozzle stream.
B. Moisten wood forms immediately before placing shotcrete where form coatings are not used.
C. Apply shotcrete according to ACI 506.2.
D. Apply dry-mix shotcrete materials within 45 minutes after predampening and wet-mix shotcrete materials within 90 minutes after batching.
E. Deposit shotcrete continuously in multiple passes, to required thickness, without cold joints and laminations developing. Place shotcrete with nozzle held perpendicular to receiving surface. Begin shotcreting in corners and recesses.
    1. Remove and dispose of rebound and overspray materials during shotcreting to maintain clean surfaces and to prevent rebound entrapment.
F. Maintain reinforcement in position during shotcreting. Place shotcrete to completely encase reinforcement and other embedded items. Maintain steel reinforcement free of overspray, and prevent buildup against front face during shotcreting.
G. Do not place subsequent lifts until previous lift of shotcrete is capable of supporting new shotcrete.
H. Do not permit shotcrete to sag, slough, or dislodge.
I. Remove hardened overspray, rebound, and laitance from shotcrete surfaces to receive additional layers of shotcrete; dampen surfaces before shotcreting.
J. Do not disturb shotcrete surfaces before beginning finishing operations.
K. Remove ground wires or other alignment-control devices after shotcrete placement.
L. Shotcrete Core Grade: Apply shotcrete to achieve mean core grades not exceeding 2.5 according to ACI 506.2, with no single core grade exceeding 3.0.
M. Installation Tolerances: Place shotcrete without exceeding installation tolerances permitted by ACI 117, increased by a factor of two.
N. Cold-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 306.1 and as follows. Protect shotcrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
    1. Discontinue shotcreting when ambient temperature is 40 deg F (4.4 deg C) and falling.
    2. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than 50 deg F (10 deg C) and not more than 90 deg F (32 deg C).
    3. Do not use frozen materials or materials containing ice or snow.
    4. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.
    5. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
O. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to recommendations of ACI 305R when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:

1. Cool ingredients before mixing to maintain shotcrete temperature at time of placement below 100 deg F (38 deg C) for dry mix or 90 deg F (32 deg C) for wet mix.
2. Reduce temperature of reinforcing steel and receiving surfaces below 100 deg F (38 deg C) before shotcreting.

3.9 SURFACE FINISHES

A. General: Finish shotcrete according to descriptions in ACI 506R.

B. Natural Finishes:
1. Gun Finish: Natural undisturbed finish as sprayed.
2. Rod Finish: Rough-textured finish obtained by screeding or cutting exposed face of shotcrete to plane with cutting rod, edge of trowel, or straightedge after initial set. Do not push or float with flat part of trowel.
3. Broom Finish: Rough-textured finish obtained by screeding or cutting exposed face of shotcrete to plane with cutting rod, edge of trowel, or straightedge after initial set; followed by uniform brooming.

C. Flash-Coat Finish: After screeding or cutting exposed face of shotcrete to plane after initial set, apply up to 1/4-inch (6-mm) coat of shotcrete using ACI 506R, Grading No. 1, fine-screened sand modified with maximum aggregate size not exceeding No. 4 (4.75-mm) sieve to provide a finely textured finish.

D. Flash-Coat with Final Finish: After screeding or cutting exposed face of shotcrete to plane after initial set, apply up to 1/4-inch (6-mm) coat of shotcrete using ACI 506R, Grading No. 1, fine-screened sand modified with maximum aggregate size not exceeding No. 4 (4.75-mm) sieve, and apply wood-float finish.

3.10 CURING

A. Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.

B. Begin curing immediately after placing and finishing but not before free water, if any, has disappeared from shotcrete surface.

C. Curing Exposed Surfaces: Cure shotcrete by one of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
a. Water.
b. Continuous water-fog spray.
c. Water-saturated absorptive covers or moisture-retaining covers. Lap and seal sides and ends of covers with 12-inch (300-mm) lap over adjacent covers.
2. Curing Compound: Apply uniformly in continuous operation by power spray according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
a. Apply curing compound to natural gun finish or flash-coat shotcrete at rate of 1 gal./100 sq. ft. (1 L/2.5 sq. m).

D. Curing Formed Surfaces: Cure formed shotcrete surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

3.11 FORM REMOVAL

A. Forms not supporting weight of shotcrete may be removed after curing for 24 consecutive hours at not less than 50 deg F (10 deg C), provided shotcrete is hard enough not to be damaged by form-removal operations and provided curing and protecting operations are maintained.
1. Leave forms supporting weight of shotcrete in place until shotcrete has attained design compressive strength. Determine compressive strength of in-place shotcrete by testing representative field-cured specimens of shotcrete.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing materials are unacceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to sample materials, visually grade cores, perform tests, and submit reports during shotcreting.

B. Air Content: ASTM C 173/C 173M, volumetric method or ASTM C 231, pressure method; one test for each compressive-strength test for each mixture of air-entrained, wet-mix shotcrete measured before pumping.

C. Shotcrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

D. Test Panels: Make a test panel, reinforced as in structure, for each shotcrete mixture and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed, whichever is less. Produce test panels with dimensions of 24 by 24 inches (600 by 600 mm) minimum and of thickness and reinforcing layout of shotcrete work on project. Testing agency will obtain sets of test specimens from each test panel.

1. Compressive Strength Testing: One set of three unreinforced specimens. Test each set of unreinforced specimens for compressive strength according to ASTM C 1140 and construction testing requirements in ACI 506.2.
2. Visual Core Grading: One set of three reinforced specimens. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.

E. In-Place Shotcrete Testing: : Only if samples obtained in item D indicate unsatisfactory shotcrete, and only if directed by Owner, Architect or Engineer, take a set of 3 unreinforced cores for each mix and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed; whichever is less. Do not cut steel reinforcement.

F. Strength of shotcrete will be considered satisfactory according to the following:

1. Specimen Cores: Mean compressive strength of each set of three unreinforced cores equals or exceeds 85 percent of specified compressive strength, with no individual core less than 75 percent of specified compressive strength.
2. Specimen Cubes: Mean compressive strength of each set of three unreinforced cubes shall equal or exceed design compressive strength with no individual cube less than 88 percent of specified compressive strength.

3.13 REPAIRS

A. Remove and replace shotcrete that is delaminated or exhibits laminations, voids, or sand/rock pockets exceeding limits for specified core grade of shotcrete.

1. Remove unsound or loose materials and contaminants that may inhibit bond of shotcrete repairs.
2. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders.
3. Dampen surfaces and apply new shotcrete.

B. Repair core holes from in-place testing according to repair provisions in ACI 301, except do not use shotcrete. Match adjacent color and finish.

3.14 CLEANING

A. Immediately remove and dispose of rebound and overspray materials from final shotcrete surfaces and areas not intended for shotcrete placement.

END OF SECTION 131102

SECTION 131103 - SWIMMING POOL TILE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and General Provisions of the contract, including General and Supplementary Conditions apply to work of this section.

1.02 SUMMARY

A. The cementitious pool finish must have ceramic tile trim on the pool vertical tile band, the zero entry trench perimeter, main drain perimeter, depth markings, wall targets, floor lane markings and other tile installations as shown and detailed on the contract drawings and in strict accordance with these specifications.

B. The CONTRACTOR must furnish and install the work of this section.

1.03 RELATED SECTIONS

A. Division 1 – Mock Ups

B. Division 7 - Joint Sealers

C. Division 9 - Ceramic Tile

D. Section 131100 - Swimming Pool

E. Section 131104 - Swimming Pool Cementitious Finish

1.04 QUALITY ASSURANCE

A. Reference Standards: Conform to the following standards unless otherwise required herein.

1. American National Standards Institute (ANSI)

a. A108.01 – General Requirements: Subsurfaces and Preparations by Other Trades.

b. A108.02 – General Requirements: Materials, Environmental, and Workmanship.

c. A108.1, Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile and Paver Tile installed with Portland Cement Mortar.

d. A108.1C – Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry Set or Latex-Portland Cement Mortar.

e. A108.5 – Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.

f. A108.6 – Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy for the Epoxy Grouting Installation Process.

g. A108.10 – Installation of Grout in Tile Work.

h. A108.13 – Installation of Load Bearing, Bonded, Waterproof Membranes for Thin Set Ceramic Tile and Dimension Stone for the Waterproofing Membrane Installation Process

i. A137.1 Standard Specifications for Ceramic Tile.

2. American Society for Testing and Materials (ASTM)

a. C144-99, Aggregate for Masonry Mortar

b. C150-00, Portland Cement

c. C171-97a, Sheet Materials for Curing Concrete

d. C206-97, Finishing Hydrated Lime

e. C207-91 (R1997), Hydrated Lime for Masonry Purposes

f. F-1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

g. F-2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes

3. Tile Council of North America (TCNA); 2021 Edition, Handbook for Ceramic Tile Installation.

4. American Concrete Institute

a. ACI 302 – Guide for Concrete and Floor Slab Construction

5. International Concrete Repair Institute (ICRI)

a. Concrete Surface Profile (CSP)

B. Tile installers must have two years' experience in similar pool projects which the Owner may require written proof thereof and proper tools to install tile.

1.05 MANUFACTURERS

A. Subject to compliance with requirements provide ceramic tile, mortar, and grout of the following manufacturers: American Olean Tile Co. (tile), Dal-Tile Co. (tile), Buchtal (tile), KlinkerSire (tile), Daldorado (tile), MAPEI, Inc. (thin-set, waterproofing, grout, and admixtures), and LATICRETE International Inc. (thin-set, waterproofing, grout, and admixtures) or approved equal.

1.06 SUBMITTALS

A. Submit shop drawings indicating tile layout, patterns, joint layout, color arrangement, perimeter conditions, junctions with dissimilar materials, thresholds and setting details.

B. Submit product data indicating material specifications, characteristics, and instructions for using adhesives and grouts.

C. Samples:

1. Mount tile and apply grout on 24"x24" backerboard to indicate pattern, color variation and grout joint size variations of each pattern. Furnish mounted tile samples as requested by the architect/owner.

D. Submit manufacturer's installation instruction.

E. Submit maintenance data.

1. Include recommended cleaning and stain removal methods, cleaning materials.

1.07 PRODUCT DELIVERY AND STORAGE

A. Deliver tile materials to site in unopened factory containers sealed with grade seals bearing printed name or manufacturer and the words "Standard Grade". Keep the grade seals intact and containers dry until tiles are used. Keep cementitious materials dry until used.

1.08 JOB CONDITIONS

A. Inspect and verify job conditions. Report defects in base surfaces for correction before proceeding.

B. Maintain environmental conditions, including temperature humidity and ventilation, within limits recommended by the manufacturer. Do not install products under environmental conditions outside manufacturer's absolute limits.

C. Do not install mortar, set, or grout tile exterior when inclement weather conditions are expected within 48 hours after work is scheduled to be completed unless proper protection is provided.

D. Maintain a temperature range of 50 degrees Fahrenheit to 90 degrees Fahrenheit during installation of tile and grout materials. Tile installation should cure for a minimum 14 days with average a temperature of 70 degrees, while maintaining the minimum 40 degrees and maximum 90 degrees Fahrenheit, prior to filling pool with water.

E. Vent temporary heaters to outside to avoid carbon dioxide damage to the new tile work.

1.09 COLORS

A. Colors must be selected by the Architect or Interior Designer. Note that swimming pool regulations may dictate color selections within the pool tank. See tile materials for price group breakdowns.

1.10 WARRANTIES

A. The CONTRACTOR warrants to the Owner that materials and equipment provided under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted and that the work will conform with the requirements of the contract documents. Work not conforming to these requirements including substitutions not properly approved and authorized, may be considered defective. The CONTRACTOR'S warranty excludes remedy for damage or defect caused by abuse, improper or insufficient maintenance, improper operation, modifications not executed by the CONTRACTOR or improper wear and tear under normal usage. If required by the Owner, provide satisfactory evidence as to the kind and quality of materials and equipment. Warranties must be for a period of five years, unless otherwise specified.

B. Setting materials must be provided by the same manufacturer. Mixing materials and application procedures must be done in accordance with manufacturer's recommendations and requirements. Documentation must be provided to this affect by the contractor with verification from the manufacturer. This documentation must be included in the operations and maintenance manual under warranties as documentation qualifying the project for a 15 Year Systems Warranty by LATICRETE International, Inc., MAPEI, Inc. or approved equal.

C. Contractor must contact the tile setting material manufacturer's technical representative to review installation details, job site conditions, selected materials, and their conformance to the manufacturer's warranty requirements prior to the commencement of work. Failure to follow these requirements will not relieve the Contractor of the requirement to provide specified warranties.

D. Contractor must agree to repair or replace work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.

PART 2 - PRODUCTS

2.01 TILE MATERIALS

A. Standard grade conforming to ANSI A137.1. Provide trimmer units as indicated and specified, including special shapes as detailed or required. Tile patterns and colors must be as indicated and specified, colors of approved shades. Mesh mounted or perforated paper backed tile is not allowed where the mesh of paper remains as a permanent part of the installation. If dot mounting is used, a minimum of 67% of the depth of the tile must be free from dots to ensure proper grout curing.

B. Tile must be "frost-proof" and suited for an outdoor pool installation in a freeze/thaw climate.

C. Unglazed Ceramic Mosaic Tile

1. Slip-resistant porcelain unglazed ceramic mosaic tile, cushion, or all-purpose edges, 2" square from price group 2 for floor, walls, and stair treads unless otherwise noted. Minimum dynamic coefficient of friction must be 0.42 for wet surfaces and 0.65 for ramped surfaces. Where special shapes are required, they must be selected from price group 3. Equivalents provided by Knoxtile, Dal-Tile or American Olean. For wet surfaces: Buchtal Chroma Mosaics with front mount film (seven color

options) 2”x2” 7161HVF or American Olean Unglazed color-body porcelain mosaics 2”x2”, price group 1-3. For ramps: Buchtal Chroma non-slip mosaics with glass fiber net (four color options) 2”x2” 7161H. Or for wet surfaces or ramps: Buchtal Chroma non-slip 5”x5” 32020H thirteen color options) or Dal-Tile or American Olean Unglazed color-body mosaics 2”x2” with 7.5% abrasive grain (7 color options). Colors must be selected by the architect.

2. Ceramic tile band below the pool gutter lip with color selected by Architect from Dal-Tile, Keystone Unglazed Mosaic, 2”x2” price group 4, American Olean Unglazed color-body porcelain mosaics 2”x2” price group 1-3, or powder glazed 2”x2” Buchtal Chroma Mosaics provided by Knoxtile.

3. Contrasting ceramic tile nosings at pool underwater benches must be Universal Trim 2”x2” with color selected by the Architect from Dal-Tile, Keystone Unglazed Mosaic, price group 3 and 4, American Olean Unglazed color-body porcelain mosaics 2”x2”, price group 1-3.

4. 4” wide contrasting ceramic tile stripe, 2” zero entry trench trim, 2” main drain trim, and 12” lane markers on the pool floor with color selected by Architect from Dal-Tile, Keystone Unglazed Mosaic, 2”x2” price group 3, American Olean Unglazed color-body porcelain mosaics 2”x2” price group 3, or from Knoxtile, as 4”x4” Buchtal Chroma Colors 22010H-717, 5556 Grey Black and 5535 Blue or 2”x2” Mosaic 7160HVF 5535 Grey Black. The main racecourse wall targets and lane markers must be black. Zero entry trench and main drain perimeter trim tiles must be white.

D. Handhold tiles at the pool perimeter must be Buchtal Chroma Handhold Edge from Knoxtile or equivalent DalLUX handhold tile from Daldorado: System Finland 119x244mm (5”x10”) 900402-55730 White with Dark Blue Safety Strip, Internal Corners (pair) 112x112mm 900402-55732 White with Dark Blue Safety Strip, External Corners 240x119mm 55736-900402 White with Dark Blue Safety Strip.

E. Provide tile trim units where indicated or necessary for a complete and finished installation. Provide rounded units for external and internal corners and angles. Provide trim units of material and finish identical to the adjoining tile. Provide SCR/L701 units where the C701 hand hold is interrupted to permit draining. Contractor should request via non-standard production. The SCR/L701 units are available through DalTile at 314-997-6970 or 1-800-672-2086.

F. Message Tile and Depth Markings

1. Horizontal and vertical depth markings and warning signs must be 6”x6” with 4” high numbers and letters. Horizontal depth markers must be slip resistant.

2.02 SWIMMING POOL / SPA TILE SETTING MATERIALS AND INSTALLATION

A. Surface Preparation

1. Surface preparation must be in accordance with ACI 302. The surface must be structurally sound and free of foreign substances and debris that could reduce or impair adhesion, free of dirt, oil, grease, curing compounds, or other foreign materials. Sound and remove loose concrete to firm substrate. Surfaces must be roughened to a CSP of 3 to 5 (reference ICRI CSP Standards for acceptable profile height). Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate must be patched per manufacturer’s recommendations.

B. Slurry Bond Coat

1. to receive a thick bed mortar application must be installed over a slurry bond coat of either LATICRETE 254 Platinum one-step, polymer-fortified, thin-set mortar or MAPEI Planislope RS polymer-modified pre-blended, rapid-setting mortar mixed with water only in compliance with ANSI A108.1A (2.2 & 5.2). As manufactured by LATICRETE International, MAPEI, Inc., or approved equal. Note that slurry bond coats are not required under vertical applications of the render and scratch coat.

C. Mortar & Leveling Beds

1. Bonded Thick Bed Method (Floor / Horizontal Surfaces): Provide a dry pack, thick mortar bed on horizontal surfaces consisting of LATICRETE 3701 Fortified Mortar Bed or MAPEI Planislope RS polymer-modified pre-blended, rapid-setting mortar mixed with water only. Apply over a properly prepared slurry bond coat. Maximum lift thickness not to exceed 2”.

2. Render- Scratch and Float Coats (Wall / Vertical Surfaces): Provide wall render (scratch and float coats) on vertical competition turning surfaces to a depth of 4'-0" below the water surface, consisting of either LATICRETE 3701 Fortified Mortar Bed or MAPEI Planislope RS polymer-modified pre-blended, rapid-setting mortar mixed with water only for lift thicknesses up to ½". Wall render is made to a plastic consistency when used vertically. Fill holes and bring surface up to line and plane as required. As manufactured by LATICRETE International, MAPEI, Inc. or approved equal. Note that slurry bond coats are not required under vertical applications of the render and scratch coat. (Refer to Course Length Tolerances for competitive pools.)

D. Tile Thin-Set

1. Use either LATICRETE 254 Platinum one-step, polymer fortified, thin-set mortar or MAPEI Keraflex Super one-step, polymer modified, thin-set mortar, used in accordance with the manufacturer's requirements. As manufactured by LATICRETE International, MAPEI, Inc., or approved equal.

E. Tile Grout

1. Use either LATICRETE SPECTRALOCK PRO Premium Grout or MAPEI Kerapoxy CQ Grout in accordance with the manufacturer's requirements as manufactured by LATICRETE International, MAPEI, Inc. or approved equal.

F. Elastomeric Sealant

1. Use LATICRETE LATASIL over LATASIL 9118 primer or MAPEI Mapesil "T" 100% silicone sealant for inside/outside corners, expansion/movement joints, and to seal lighting/plumbing fixture penetrations. Primer and sealant installation must be in accordance with the manufacturer's requirements. As manufactured by LATICRETE International, Inc., MAPEI, Inc. or approved equal.

G. Mixing and application procedures must be in accordance with the manufacturer's recommendations and requirements. The manufacturer's representative must visit the site to verify field conditions, confirm materials and application requirements and ascertain that materials and systems are so installed. Documentation must be provided to this effect.

PART 3 - EXECUTION

3.01 PREPARATION

A. Complete water tightness test prior to tile installation. Concrete tank must be watertight per ASTM D5957, the Tile Council of North America, and specification 131100.

B. Clean substrates of dust, dirt, oil, grease, curing compounds and other foreign substances and mechanically roughen concrete and shotcrete for bond. Conform to applicable reference standards and to recommendations of manufacturers of materials used and meeting ICRI, CSP.

C. Substrates to Receive Mortar Setting Beds

1. Dampen concrete substrate to receive tile work according to above referenced standards or tile manufacturer's instructions, as required.

D. Substrates to receive thin set tile applications must meet normal construction tolerances of 1/4" in 10' where competition tolerances do not apply and must meet competition tolerances where required elsewhere in these specifications, and must be free of bumps, dips and surface irregularities that may affect the satisfactory installation of the tile.

E. Tile Wetting

1. Dampen tile according to above reference standards or tile manufacturer's instructions, as required.

F. Screeds

1. Accurately set temporary screeds to control the finish plane of mortar-bed set tile and remove as soon as setting bed is sufficiently hardened. Fill void spaces from screeds with same mortar.

3.02 TILE INSTALLATION

A. Arrange tile according to patterns detailed. Set tile with flush well-fitted joints, finished in true planes, plumb, square, joints of uniform size. Provide approved trimmers as shown or required. Cut tile without marring. Carefully grind and joint tile edges and cuts.

B. Follow Tile Council of North America installation methods P601 and B417 to achieve total tile system thickness for thin or thick set.

1. Thin Set

a. Apply specified bond coat on cured and dried concrete pool shell. Trowel 3/32" to 1/8" thick bond coat over concrete pool shell just before setting tile or apply bond coat to back of each tile placed. 95% coverage of the back of the tile or tile sheet is required. Set tile in position and beat firmly into the setting bed mortar. Bring tile faces to a true and correct plane. Complete beating and leveling before mortar sets and in no case later than one hour after first placing. When ready, wet and remove paper and glue avoiding excess water. At this time adjust out-of-line or out-of-level tile.

C. Finished tile surface must be level and in plane, with no sharp or protruding edges. Tiles out or plane more then 1/16" must be removed and replaced. Sharp edges must be stoned smooth.

D. Grout Joint Sizes

1. Unless otherwise approved, install tile with uniform 3/32" joint width. A maximum 1/8" joint width may be utilized to meet specific installation requirements, if required.

E. Ceramic Tile Joint Grouting

1. Mix grout to a thick creamy consistency and force into joints for entire thick depth, flush with surface. Clean off excess and fill skips and gaps before grout sets. Color selection by Architect or Interior Designer. Provide dampness for minimum 3-day curing and polish with clean dry cloths (not required when epoxy grouts are used).

F. Expansion Joints

1. Place expansion joint per applicable TCNA Method P601MB, P601TB, or P602 and conforming to Method EJ171. Provide shop drawings showing backer rod and joint dimensions. Expansion, control, construction, cold, and seismic joints in the pool structure should continue through the tile work, including such joints at vertical surfaces. Movement joints must be placed at changes in direction and elevation. Refer to the structural engineer for additional required movement joints. Joint size must be a minimum of 1/8". Joints through tile work directly over structural joints must not be narrower than the structural joint. The Contractor must use cement compatible coatings when using chalk lines for joint layout purposes.

G. Fill and Empty Rates

1. Use a fill and drain rate of 2'-0" per 24 hours to minimize thermal shock and structural movement. Maintain a temperature differential of 10 degrees Fahrenheit or less between the pool water and the substrate during fill and drain cycles.

3.03 TESTING AND INSPECTION

A. Before filling of the pool, and its subsequent provisional acceptance at substantial completion, the tile installation must be visually inspected and sounded in the presence of the Architects and/or the Owner's representative to verify mortar coverage below the tile to its substrate as well as its overall compliance with the requirements of this Section.

B. Tile work found loose, lacking proper mortar coverage, out of plane, misaligned or otherwise non-conforming must be removed and replaced at no additional cost to the Owner.

3.04 CLEANING

A. Upon completion of placement and grouting, clean tile installation as recommended by TCNA and manufacturers of proprietary materials. Tile must be cleaned with pH neutral solutions, free of both sodium and potassium, in accordance with the tile and grout manufacturer's printed instruction.

B. Leave finished installation clean and free of cracked, chipped, broken, un-bonded or otherwise defective tile work.

C. Protect installed tile work with non-staining Kraft paper, polyethylene sheeting, or other approved heavy covering during the construction period to prevent damage.

3.05 REPLACEMENT TILE

A. Provide Owner with approximately 10% or 25 square feet (whichever is least) of each color and type tile used on the project for Owner’s repair and replacement requirements.

END OF SECTION 131103

SECTION 131104 - SWIMMING POOL CEMENTITIOUS FINISH

PART 1 - GENERAL

1.01 SUMMARY

A. Provide a conventional Diamond Brite or Pebble Tec to the pool structure(s). Provide installation of bond coat prior to application of pool finishes in strict accordance with manufacturer's instructions. Provide ceramic tile trim on the pool vertical tile band, the zero entry trench perimeter, main drain perimeter, depth markings, wall targets, floor lane markings and other tile installations as shown and detailed on the contract drawings and in strict accordance with these specifications.

B. Provide water analysis and pre-fill requirements.

1.02 SUBMITTALS

A. Samples

1. Prepare 12-inch square panel at the site showing color and texture for pool plaster. Finished cementitious finish work must match the approved sample panel.

B. Certificates

1. Submit certificates attesting that the materials provided meet the requirements specified herein.

C. Test Report

1. Submit results of domestic water analysis and calculation of amounts of chemicals required to balance pool water on initial fill of pool.

1.03 PRODUCT DELIVERY AND STORAGE

A. Deliver manufactured materials to site in manufacturers' original unbroken packages or containers bearing manufacturers' name and brand labels. Keep cementitious materials dry until ready to be used and stored off the ground, under cover and away from damp surfaces.

1.04 JOB CONDITIONS

A. Apply plaster in swimming pool only when ambient temperature is above 40 degrees F and below 90 degrees F and protect applied plaster from rapid drying by sun or wind until curing is completed or pool is filled with water. Confirm and comply with applicable manufacturer's installation requirements.

1.05 QUALITY ASSURANCE

A. Plaster installers must have two years' experience in similar pool projects which the Owner may require written proof thereof and proper tools to install plaster.

PART 2 - PRODUCTS

2.01 DIAMOND BRITE

A. The CONTRACTOR must provide a slip-resistant proprietary plaster finish in the areas indicated on the drawings. Description: Diamond Brite finish must be a blend of selected quartz aggregates and fortified white Portland cement. Color and texture selected by the Architect. Confirm installation requirements with the manufacturer.

B. Surface Preparation

1. Surface must be structurally sound and free of foreign substances and debris that could reduce or impair adhesion, free of dirt, oil, grease, curing compounds or other foreign materials. Sound and remove loose concrete to firm substrate. Surfaces must be roughened by sand blasting or water

blasting. Shot blasting, scarifying, or grinding can also be accepted methods of surface preparation. Pressure-wash the entire surface. Wash with trisodium phosphate (TSP) using a stiff broom. Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate must be patched per manufacturer's recommendations. Lightly moisten walls and floors prior to application of Diamond Brite.

C. Bond Coat

1. Bond Kote by SGM, Inc., or approved equal, in strict accordance with manufacturer's instructions. Apply and cure bond coat per manufacturer's recommendations. After proper curing of bond coat, lightly moisten with clean potable water prior to application of cementitious finish. Ensure bond coat is free of foreign matter prior to plastering.

D. Mixing

1. Thoroughly mix Diamond Brite to a homogeneous lump-free consistency using 1-1/2 to 2 gallons of potable water per 80 lb. bag.

E. Application

1. Diamond Brite must be applied to a uniform thickness of 3/8" to 1/2" over the entire surface. The walls must be scratch coated followed by a finish coat. Material applied to the floor after the walls have been applied must be accelerated to assure uniform setting time throughout the pool surface.

F. Coverage

1. Each 80 lb. bag to cover approximately 25 square feet to a thickness of 3/8".

G. Proprietary plaster finish must be applied by a licensed applicator as approved by the manufacturer.

2.02 PEBBLE TEC

A. The CONTRACTOR must provide a slip-resistant pebble stone surface in the areas as indicated on the drawings. Description: Pebble Tec finish must be a blend of selected colored aggregates and fortified white Portland cement. Color and texture selected by the Architect. Finish to consist of Pebble Tec as supplied by Pebble Technology, Inc. (480) 948-5058, or approved equal. Confirm installation requirements with the manufacturer.

B. Surface Preparation

1. Surface must be structurally sound and free of foreign substances and debris that could reduce or impair adhesion, free of dirt, oil, grease, curing compounds or other foreign materials. Sound and remove loose concrete to firm substrate. Surfaces must be roughened by sand blasting or water blasting. Shot blasting, scarifying, or grinding can also be accepted methods of surface preparation. Pressure-wash the entire surface. Wash with trisodium phosphate (TSP) using a stiff broom. Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate must be patched per manufacturer's recommendations. Lightly moisten walls and floors prior to application of Pebble Tec.

C. Bond Coat

1. Scratch Kote System by Multicoat Corporation, Bond Kote by SGM, Inc., or approved equal, in strict accordance with manufacturer's instructions. Apply and cure bond coat per manufacturer's recommendations. After proper curing of bond coat, lightly moisten with clean potable water prior to application of cementitious finish. Ensure bond coat is free of foreign matter prior to plastering. If over a waterproof membrane, refer to waterproof section of Swimming Pool specification, section 131100, paragraph 2.16.

D. The cement-pebble stone mixture must be pneumatically applied to the pool surface.

E. After application of Pebble Tec material the surface must be hand troweled for exposure of pebble material.

F. Spray down troweled surface with water to remove excess cement and exposure of pebbles.

G. Surface is allowed a minimum of a 24-hour hardening period. Upon hardening the surface is cleansed with an approved solution as provided by the manufacturer for final exposure and luster of pebble surface.

H. Surface must be buffed so as to ensure sharp edges are removed and final surface texture is per the manufacturer's recommendations.

I. Natural pebble stone surface must be applied by a licensed applicator as approved by the manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES AND BOND COAT

A. Surface must be structurally sound and free of foreign substances and debris that could reduce or impair adhesion, free of dirt, oil, grease, curing compounds or other foreign materials. Sound and remove loose concrete to firm substrate. Surfaces must be roughened by sand blasting or water blasting. Shot blasting, scarifying, or grinding can also be accepted methods of surface preparation. Pressure-wash the entire surface. Wash with trisodium phosphate (TSP) using a stiff broom. Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate must be patched per manufacturer's recommendations.

1. National Plasterers Council Surface Preparation Definitions

a. Pressure Washing: The washing or cleaning of a surface by a stream of water ejected from a nozzle at high velocity, typically in the range of 1,000 psi – 4,000 psi.

b. Water Blasting: The cutting, abrading, or removal of a surface or substrate by a stream of water ejected from a nozzle at ultra-high velocity, typically in the range of 10,000 psi – 40,000 psi.

2. Apply and cure bond coat in strict accordance with manufacturer's instructions. After proper curing of bond coat, lightly moisten with clean potable water prior to application of cementitious finish. Ensure bond coat is free of foreign matter prior to plastering.

B. Do not apply finish materials to base surfaces containing frost. Provide temporary coverings as required to protect adjoining surfaces from staining or damage by plastering operations.

C. Protect or mask adjacent surfaces that are not scheduled to receive cementitious finish. If expansion or construction joints exist in the areas where cementitious finish will be applied cover plastic joints for protection (if plastic joints are used). Additionally, mark joints for saw-cutting if area will be saw-cut.

D. Verify that concrete surfaces that are to receive a cementitious finish have cured for a minimum of 5 days. Consideration should be given for the application of a primer for concrete structures that is over 28 days old to improve bonding.

3.02 APPLICATION OF CEMENTITIOUS FINISH

A. General

1. Confirm application requirements with the manufacturer. Apply finish plaster to the properly prepared substrate at the minimum thickness required by the manufacturer, but no less than 3/8-inch thickness. Apply finish plaster by hand or machine. If plastering machine is used, control fluidity of plaster to have a slump not exceeding 2-1/2 inches when tested using a 2" by 4" by 6" high slump cone. Do not add additional water to the mix subsequent to determining water content to meet this slump. Perform slump test according to following procedure:

a. Place cone on level, dry non-absorptive base plate.

b. While holding cone firmly against base plate, fill cone with plaster taken directly from hose or nozzle of plastering machine, tamping with a metal rod during filling to release air bubbles.

c. Screed off plaster level with top of cone. Remove cone by lifting it straight up with a slow and smooth motion.

d. Place cone in a vertical position adjacent to freed plaster sample suing care not to jiggle base plate.

e. Lay straightedge across top of cone being careful not to vibrate cone, measure slump in inches from bottom edge of straightedge to the top of slumped plaster sample.

2. Mixing of materials and application procedures must be done in accordance with the manufacturer's recommendations and requirements. The manufacturer's representative must visit the site to verify field conditions, confirm materials and application requirements and ascertain that materials and systems are so installed. Documentation must be provided to this effect.

B. Workmanship

1. Unless otherwise required by the manufacturer, apply finish plaster in two coats by "double-back" method with second coat applied as soon as first coat is tamped and initially floated. Apply plaster with sufficient pressure to provide a good bond on bases. Work plaster to screeds at intervals of from 5 feet to 8 feet on straight surfaces. Apply smooth trowel finish without waves, cracks, trowel marks, ridges, pits, crazing, discoloration, projections, or other imperfections. Form plaster carefully around curves and angles, well up to screeds. Take special care to prevent sagging and consequent drooping of applications. Produce surfaces free of visible junction marks in finish coat where one day's work adjoins another. Finish proprietary plaster as required by the manufacturer.

2. Cementitious finishes must be applied by a licensed applicator as approved by the manufacturer.

C. Curing

1. Curing cementitious finishes with fine fog water spray applied to finish coat as frequently as required to prevent dry-out of surface, or as directed by the manufacturer of the cementitious finish. Keep plaster damp until pool is filled. Prevent damage or staining of plaster by troweling or curing.

D. Patching, Pointing, and Cleaning Up

1. Upon completion, cut out and patch loose, cracked, damaged, or defective plaster; patches matching existing plaster in texture, color, and finish, flush with adjoining plaster. Perform pointing and patching of surfaces and plasterwork abutting or adjoining other finish work in a neat and workmanlike manner. If 10 percent or more of the pools plaster finish is found to be defective, the plaster must be removed and replaced complete from surfaces. Remove plaster droppings or spattering from surfaces. Leave plaster surfaces in clean, unblemished condition ready for pool filling. Remove protective coverings from adjoining surfaces. Remove rubbish and debris from the site.

3.03 PRE-FILL SPECIFICATION

A. Contractor must employ a qualified water testing agency to analyze the domestic water with which the pool will be filled within 2 weeks of the plaster date and must employ a swimming pool experienced water chemistry consultant to determine types and quantities of chemicals required to ensure calcium-balanced water immediately upon the completion of water filling. Refer to section 131100 for water filling requirements.

1. Have on hand quantities of the chemicals as determine above, plus 25% overage for follow-up treatment. These chemicals, typically including calcium chloride, bicarbonate of soda, and muriatic acid are in addition to standard bromine/chlorine products and alkalizer/pH control products required elsewhere.

B. The pool(s) must not be plastered until directed by the Owner's representative and the filtration system and chlorination system are complete and ready for start-up. The Contractor must supply chemicals required for treatment of the pool water.

C. The Contractor must submit domestic water analysis to the Owner and/or Architect at least 2 weeks prior to filling the pool(s).

END OF SECTION 131104

SECTION 131106 - SWIMMING POOL TIMING SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT and applicable parts of DIVISION 1 - GENERAL REQUIREMENTS, as listed in the Table of Contents, must be included in and made a part of this Section.

1.02 SUMMARY OF WORK

A. Introduction

1. Provide labor, materials, equipment and services necessary to provide a complete electronic timing and scoreboard system with multi-sport capability for race swimming.

B. Work included in this section

1. It is the intent of this section to place the entire responsibility for the complete electronic timing and scoreboard system (including appropriate connections) with multi-sport capability under one vested supplier. The supplier is responsible for providing full integration of this system. Multiple suppliers for a system will not be approved.

C. Related work specified in Electrical sections. Reference Division 16 or 26 – Electrical. Work must be completed by other contractors.

1. Ground and bond pool structures, fittings and equipment in accordance with Article 680 of the N.E.C. Test and verify that the system electrical ground is true and solid. Provide certification to this effort.

2. Obtain permits, inspections, and approvals of wiring including grounding and bonding of metal components associated with the pool in accordance with Local, State and National Electrical Codes.

3. Provide power, conduits, electrical boxes, ethernet connections and wiring for the Contractor provided electronic timing and scoreboard system with multi-sport capability for race swimming.

4. Supply junction boxes for equipment outlined in these specifications and depicted on the timing system drawings.

D. Basis of Design:

1. The complete electronic timing and scoreboard system with multi-sport capability is based upon Colorado Timing System, Inc.

1.03 ACCEPTABLE MANUFACTURERS AND SUPPLIERS

A. Colorado Time Systems, Inc. (Basis of Design)

1.04 SUBMITTALS

A. Submittals must include the following:

1. Product data

2. Shop drawings detailing system layout

3. Operations and maintenance manuals for system. Manuals must include a complete parts list.

4. Warranty for each piece of equipment within this section.

1.05 JOB CONDITIONS

A. Manufacturers proposing to submit a quotation for the electronic timing and scoreboard system must confirm that embedded items are compatible with the installation of their respective systems.

B. Manufacturers must review the construction documents and must notify the architect 10 days prior to the bid date of conflicts or additions to the work of other subcontractors for the proper installation of their system.

1.06 WARRANTIES

A. The CONTRACTOR must warranty the completed installation of systems in this section for one year.

B. The manufacturer must warranty the computer consoles, touchpads, pace clocks and starting system for two years.

C. The manufacturer must warranty the titanium timing system wall plate and deck plates for five years.

D. The manufacturer must warranty the scoreboard for five years.

PART 2 - PRODUCTS

2.01 SCOREBOARD SYSTEM

A. Full Color Video Display

1. Full Color Video Display system must display necessary information to time swimming in compliance with the appropriate sanctioning body - USA SWIMMING. . Display must provide competitor's names, full matrix graphics and animation, live video, and have advertising capabilities.

    a. Basis of Design: Multi-Sport LED Scoreboard System is based upon Colorado Timing System, Inc.

2. Display must include the following: Full matrix LED scoreboard with computer controller and DisplayLink+ software, flat-wall mounting hardware and data/fiber cable up to 500'.

3. Display must be a full color LED matrix display. Display must be comprised of red, blue and green LEDs to form pixels. Display must be capable of 281 trillion shades of color.

4. Display should be capable of 16-bit video processing, one hundred (100) levels of dimming capability and allow for Gamma correction.

    a. Display intensity must be adjustable between 1200-8500 nits.

5. The display must have a built-in graphics and animation capability with Windows- based software. Graphics and animation must have the capacity of being displayed on the entire matrix. MS Windows fonts must be compatible with the display.

6. Display must have the ability to show live video or DVD's.

7. Display must allow for front service access.

8. Display must include 3% spare critical parts.

9. Operation temperature must be between -4ºF - 122ºF (-20ºC - 50ºC).

10. Humidity tolerance must be between 0%-95% non-condensing.

11. Each indoor pixel must be comprised of 3 LEDs, 1R1G1B SMD LED package.

12. Display must include LED video controller with the following functions/features at a minimum:

    a. Dual zone, picture in picture capable with on the fly user defined window sizes.

b. Hardware controlled scaling of all video input sources, PC (computer) based scalers are not an accepted alternative.

c. Must have a simple to use menu architecture allowing user to switch between video inputs and layouts with minimal keystrokes.

d. Controller must have a minimum of five (5) user defined display layout templates capable of switching between sources as well as zone layouts accessible via controller main menu.

e. Display controller must accept the following video input signals:

1) One (1) DVI that supports HDCP

2) One (1) HD-SDI

3) One (1) HDMI

4) Two (2) VGA

5) One (1) DP

6) Two (2) composite

f. Display controller must include following output signals:

1) (1) DVI Loop (Follows DVI Input signal)

2) *(1) DVI Monitor (Courtesy monitor for review of signal to display)

3) *(1) VGA Monitor (Courtesy monitor for review of signal to display)

4) (1) HD-SDI Loop (Follows HD-SDI Input Signal)

5) (4) LED Outputs (Primary and (3) backup outputs to LED display)

6) *Monitor outputs up to 1920x1200@60Hz output resolution.

13. Scoreboard details must be as follows. Exact cabinet dimensions, detailed drawings, and weight must be provided with the submittals.

a. Minimum Viewing Distance: 50 ft to 150 ft.

b. Pixel Spacing: 10-12 MM

c. Active Area: 10.41(H) x 18.35(W)

d. Pixel configuration must be: 112 PIXELS HIGH x 208 PIXELS WIDE

e. Weight: 300 LBS

B. Scoreboard Hanging Requirements

1. Scoreboard manufacturer must provide drawings with hanging information.

a. Material: Scoreboard hangers must be galvanized steel for an indoor natatorium.

b. Coordinate scoreboard hanging requirements with structural engineer prior to the submittal process.

2. Anchors

a. Hollow Block Construction

1) Sleeve type anchors feature a split expansion sleeve over a threaded stud bolt body and integral expander, nut and washer. Anchors must be made of zinc plated Carbon Steel, or Type 18-8 Stainless Steel. Anchors should be installed with carbide tipped hammer drill bits made in accordance to ANSI B212.15-1994. Anchors must be tested

to ASTM E488 criteria and must meet or exceed U.S. Government G.S.A. specification A-A-55614 Type 2 (Formerly GSA: FF-S-325 Group VIII, Type 2), California State Fire Marshal, Factory Mutual and Underwriters Laboratories.

b. Filled Block or Solid Concrete Construction:

1) The anchor must be a torque-controlled expansion anchor, which provides consistent performance for a wide range of mechanical anchor applications. This anchor series is available in carbon steel with zinc electroplated coating, carbon steel with hot-dip galvanized coating, 304 stainless steel and 316 stainless steel versions. The threaded stud version of the anchor is available in a variety of diameters ranging from 1/4- to 1-in. depending on the steel and coating type. Applicable base materials include normal-weight concrete, structural lightweight concrete, lightweight concrete over metal deck, and grout-filled concrete masonry. Basis of design is AISI Type 316 stainless steel KWIK Bolt 3 (KB3) manufactured by Hilti, Inc.

2) Three anchors must have an anchor body, nut and washer that conform to AISI Type 316. The expansion wedges conform to AISI Type 316 stainless steel.

3) Anchor bodies smaller than 3/4-inch, excluding KWIK Bolt 3 Countersunk, are produced from AISI Type 304 or Type 316 stainless steel having the bolt fracture loads shown in table 1. Anchor bodies 3/4-inch and larger, and stainless-steel KWIK Bolt 3 Countersunk anchor bodies are produced from AISI Type 304 or Type 316 stainless steel having the mechanical properties shown in table 1. Nuts meet the dimensional requirements of ASTM F594. Washers meet the dimensional requirements of ANSI B18.22.1, Type A, plain. Stainless steel expansion wedges for AISI Type 304 are made from either AISI Type 304 or Type 316. Stainless steel expansion wedges for AISI Type 316 anchors are made from type 316. Stainless-steel nuts and washers for AISI Type 304 or Type 316 anchors are manufactured from AISI Type 304 or 316, respectively.

3. Supports

a. Unistrut

1) Material

a) Fittings, unless noted, are made from hot-rolled, pickled and oiled steel plates, strip or coil, and conform to ASTM specifications A575, A576, A635, or A36. The fitting steel also meets the physical requirements of ASTM A1011 SS GR 33. The pick-ling of the steel produces a smooth surface free from scale. Many fittings are also available in stainless steel, aluminum and fiberglass. Consult factory for ordering information.

2) Finishes

a) Fittings are available in: Perma-Green III (GR), Electro-galvanized (EG), conforming to ASTM B633 Type III SC1; Hot-dipped galvanized (HG), conforming to ASTM A123 or A153.

4. Brackets

a. Per ANSI B1.1- Surface roughness per ANSI B46.1- Surface roughness on holes 250 MAX unless otherwise specified. Variations in form from unmachined features are permitted within established –l filets 0.005-0.020 (APPROX. RADIUS) – Screw threads per ANSI B1.1- Pipe threads commercial standards. Edges and corners 0.005-0.020 (approx. radius or chamfer).

b. Materials and components used in the assembly of this item must be RoHS complaint material: 12GA (.105) HRS. The finish must be ZINC CLEAR CHROMATE PLATED. Manufacturer must break sharp edges and corners.

c. Support hardware, brackets, fasteners, hangers, etc. used during installation of the scoreboard must be Zinc Clear Chromated Plated.

C. Software to Control Matrix / Video Display must include the following:

1. Operates full color LED matrix displays.
2. Receives data from all sports timers and scoring consoles.
3. Receives data from 3rd party meet management software.
4. Displays standard graphics formats (JPG, GIF, BMP, PNG).
5. Playback of standard digital video (AVI, MPG, WMV).
6. Allows creation of custom data templates with sport-specific information.
7. Creates and plays sequences of templates and graphics, with transition effects.
8. Stores name and team information for up to 12 lanes for an infinite number of events and heats.
9. Stores multiple diving event orders, with name and team information.
10. Supports any Windows font as well as custom CTS bitmap (pixel-mapped) fonts.
11. Graphics and templates can be used to provide in-venue advertising.
12. Multiple options for displaying team scores and full event results (standalone or in conjunction with meet management software).
13. Quick message feature allows user-driven dynamic messaging.
14. Provides user ability to schedule automatic display of templates and graphics, with recurrences.
15. Allows creation of multiple outputs regions for multizone displays or multiple displays of varying resolutions.
16. Allows creation of transparent overlay templates, facilitating sports data overlaid on still and video graphics backgrounds.
17. Runs on Windows 8.1 and greater.
18. Provides customer initiated remote technician assistance and fault monitoring.

2.02 MULTI-SPORT COMPUTER/TIMING SYSTEM

A. Multi-Sport Computer/Timing System must be supplied with necessary software to time swimming, in compliance with the appropriate sanctioning body - USA SWIMMING.

1. Basis of Design: Multi-Sport Computer/Timing System is based upon the GEN7 TIMING as manufacturer by Colorado Timing System, Inc.

B. Multi-Sport Computer/Timing System must be a standalone unit with physical connections to timing inputs. Timer must be controlled by user interface device (e.g., computer, tablet, etc.) via USB or TCP/IP.

1. Timer PC or tablet interface device must be supplied with necessary software to time and score swimming in compliance with the appropriate governing organization(s) - USA SWIMMING.
2. Configuration of racecourses must be through graphical user interface. It is unacceptable that race configurations need specific cable connections to system connections such as wall plates defining a specific end of a course.

3. User interface must display complete race status. The interface must be capable of functioning as miniature scoreboard displaying information simultaneously for active lanes including lane number, current length in race or final place, split or finish time, relay judging status indicator, and backup time and backup button status.

4. Timer must automatically flag timing discrepancies (in the user interface, on the results printouts and in stored memory) greater than a user defined interval between touch pad and backup times.

C. Multi-Sport Computer/Timing System input/output ports must include:

1. Must accept inputs for up to 4 courses of up to 32 lanes each for a serial in-deck wiring installation and must be able to time them simultaneously.

2. Up to 8 timers must be supported to accept inputs of the same in-deck wiring installation for parallel race timing and backup.

3. Must accept on-deck cable harness inputs for up to 20 lanes near end and/or far end.

4. Must communicate with meet management peripheral software on a two-way "handshake" basis, enabling the meet manager's resident computer to query the timer's memory via the USB port or via the network at any time for any race results.

5. Must provide backup time via push button provided on a per lane basis should swimmer fail to trigger touch pad or touch pad fail to register. Timer must be capable of accepting up to three backup button times per lane.

6. Must automatically compare the touch pad hit of an incoming swimmer with the starting swimmer's time of departure from the optional relay-judging platform. Results display both "plus" and "minus" takeoff times and can be printed and stored in race memory

D. Accuracy of Multi-Sport Computer/Timing System:

1. Must time to a user-selectable resolution from 1 second to .001 second. It must take starts and finishes from the near end and/or far end of the pool. It must accept inputs from the start system; touch pads, up to three manual button backup times per lane, and relay judging platforms.

2. Must be able to evaluate and report multiple states of timing component input condition, ranging from excellent to failure. It is unacceptable that only two states such as on or off are reported.

3. Must have touch pad delay feature with ability to program delays from 1 to 99 seconds.

4. Must permit the operator to correct for an erroneous touch by adding/subtracting a touch pad hit to correct the lengths completed. The interface must not permit the operator to finish a race in any lane; timers including such a function are unacceptable because they permit the possibility of cheating.

5. Later recall of stored race data must allow for a re-run of a given race including changes in user decisions.

E. Multi-Sport Computer/Timing System Detection:

1. Must be capable of detecting timing components such as pushbuttons, touchpads, RJPs, speakers, Speedlight and start systems connected to an in-deck system and capable of detecting touchpads and RJPs connected to an on-deck system.

2. Must be capable of reporting corrosion in the in-deck wiring installation.

F. Multi-Sport Computer/Timing System must run off a 12 Volt power supply connected to a standard 110/240 VAC outlet and will automatically switch to (and display on screen of connected interface device) internal battery power source, in case of line power failure without affecting the continuity and accuracy of the timing system.

G. Multi-Sport Computer/Timing System must interface to single-line and multi-line scoreboard and must post immediate results to scoreboard in “Lane” or “Place” order (user selectable). The timer must also have the capability to pull race results from memory and post those results to the scoreboard in “Lane” or “Place” order (user selectable).

H. Multi-Sport Computer/Timing System must include internal clock calendar with self-sustaining battery to time/date stamp results.

I. Multi-Sport Computer/Timing System must meet acceptable safety standards. Must be UL approved, or equivalent.

J. Multi-Sport Computer/Timing System Storage and Internal Memory:

1. System must store each and every timing input state change. It is not acceptable that state changes get discarded and are not available for later re-evaluation of a race.

2. Race data, including near and far end splits, must be stored to internal memory for later recall to facilitate meet management connectivity and printing. Printed reports must include cumulative and subtractive splits as well as relay judging times (when required).

3. Meet memory must be capable of being transferred to external storage (via USB) or cloud data backup services (e.g., DropBox, Google Drive).

K. Multi-Sport Computer/Timing System must have an Automatic Event Sequencer that is capable of holding both standard and user defined event sequences. The event order will be able to be downloaded from meet management software. The desired order is user selectable. EVENT SEQUENCES with appropriate race distance and race description for high school, college meets, and two “User Defined” meets to permit construction of custom meets, USA SWIMMING. When recalled from memory, race distance and descriptions are automatically selected for the operator.

L. Multi-Sport Computer/Timing System must have a user interface software that permits operation of essential functions including Lane Off/On, Finish Arm, Split Arm, & Print Results directly from the main screen to ensure speed and simplicity of operation during critical race times. The interface must permit the operator to edit a time when required or to disqualify a lane (DQ), automatically posting it to the scoreboard, and provide automatic re-ranking of results. Corrections generated by the operator (edit or disqualification) must be clearly identified on the results printouts.

M. Multi-Sport Computer/Timing System must include electronic beeper and LED signaling to indicate touchpad, backup button and RJP inputs. Timers which do not allow the user to configure (enable/disable) this feature are unacceptable.

N. Multi-Sport Computer/Timing System connectivity must include:

1. USB (Type A) port for external storage

2. USB (Type B) port for meet management connectivity

3. USB (Type B) port for user interface computer connectivity

4. Ethernet port for network connectivity

5. 3 independent scoreboard output ports

6. Wireless 2.4GHz scoreboard connectivity

7. Connection for in-deck wiring and two connections for on-deck (near and far end) wiring

8. Start system connection directly to timer

9. External DC power port

O. Multi-Sport Computer/Timing System must be capable of updating internal software/firmware via Internet connection.

P. Multi-Sport Computer/Timing System software must have the ability to adjust the intensity of LED scoreboard brightness.

2.03 SWIMMING TIMING SYSTEM CONNECTORS

A. General Description

1. The timing system must employ topology of a single communication bus to which timing and connectivity nodes are connected and communicate with each other.

2. Connection points must be production items and not a one off or prototypes

3. Exposed connectors must feature titanium contacts. They must be wet pluggable and electrically passive if not connected. No maintenance to prevent corrosion of deck plate connector contacts is needed.

4. Self-test capabilities to detect compromised timing bus wire terminations and scoreboard bus wire terminations

B. Wall Plates

1. Wall plates must be provided as required in the quantities as shown on the drawings. Wall plates must be the termination point for connections between deck cables, timers, start system, and other wall plates.

a. Basis of Design: Wall plates are based upon TITANIUM SERIAL WALL PLATE as manufactured by Colorado Timing System, Inc.

2. Wall plates must allow for the following connections depending on location and usage:

a. Connection to the timer.

1) Connectivity to timing courses and one scoreboard bus with one cable connection.

2) Detection of presence or absence of connected timer.

3) Diagnostic capabilities to detect anomalies with connectors (corrosion, shorts).

b. Connection to a start system and must provide the following:

1) Inputs for start system and speaker.

2) Diagnostic capabilities to detect anomalies with connectors (corrosion, shorts) and anomalies with the speaker input or start system.

3) Detection of presence or absence of speaker input or start system.

c. Connection to a scoreboard and must provide the following:

1) Detection of presence or absence of connected scoreboard.

2) Self-test capabilities to detect compromised timing bus wire terminations.

3. Junction Boxes (Provided by Electrical Contractor):

a. Wall plate timing system components must fit into a 12” x 12” x 6” PVC junction box.

b. Acceptable Manufacturer: Cantex (P/N 5133713) or similar box that will fit wall plate assembly of the following dimensions: 12” x 12” x 6” +-0.05”, cover plate width must be 15” +-0.02” square

c. Conduit interconnects between timing system boxes (deck plates and wall plates) must be PVC. Refer to drawings for sizing.

d. Verify routing of conduit with timing system manufacturer prior to install.

C. Wall Plates

1. Wall plates must be provided as required in the quantities as shown on the drawings. Wall plates must be the termination point for connections between deck cables, timers, start system, and other wall plates.

    a. Basis of Design: Wall plates are based upon TITANIUM SERIAL WALL PLATE as manufactured by Colorado Timing System, Inc.

2. Wall plates must allow the following connections depending on location and usage:

    a. Connection to the timer.

        1) Connectivity to timing courses and one scoreboard bus with one cable connection

        2) Detection of presence or absence of connected timer

        3) Diagnostic capabilities to detect anomalies with connectors (corrosion, shorts)

    b. Connection to a start system and must provide the following:

        1) Inputs for start system and speaker.

        2) Diagnostic capabilities to detect anomalies with connectors (corrosion, shorts) and anomalies with the speaker input or start system.

        3) Detection of presence or absence of speaker input or start system.

    c. Connection to a scoreboard and must provide the following:

        1) Detection of presence or absence of connected scoreboard.

        2) Self-test capabilities to detect compromised timing bus wire terminations.

3. Junction Boxes (Provided by Electrical Contractor):

    a. Wall plate timing system components must fit into an 8” x 8” x 7” PVC junction box.

    b. Acceptable Manufacturer: Cantex (P/N 5133708) or similar box that will fit wall plate assembly of the following dimensions: 7.5” x 7.5” x 6” +-0.05”, cover plate width must be 9.8” +-0.02” square.

    c. Conduit interconnects between timing system boxes (deck plates and wall plates) must be PVC. Refer to drawings for sizing.

    d. Verify routing of conduit with timing system manufacturer prior to install.

D. Deck Plates

1. Deck plates must be provided as required in the quantities as shown on the drawings. Deck plates to permit plug-in connection for touch pads, A, B, C, backup buttons, electronic relay judging, start light signal, start speakers and a signal to start the timing device at each lane.

    a. Basis of Design: Deck plates are based upon TITANIUM SERIAL DECK PLATE as manufactured by Colorado Timing System, Inc.

2. Domed deck plate node with contacts mounted on integrated slopes that cause corrosive pool water which creates water bridges to flow off through gravity, overcoming water surface tension and therefore reducing electrolytic currents and corrosion. No maintenance for corrosion is needed.

3. Titanium contacts as exposed connectors.

4. Inputs for button A, B, C, touchpad, start system, speaker, RJP and Speedlight (RJP as separate input, not piggy backed on another input).

5. Speedlight must be controlled in synchronicity and individually per lane (requires RJPs).
6. Diagnostic capabilities to detect anomalies with connectors (corrosion, shorts) and anomalies with the timing components push buttons, touchpad, RJP, Speedlight, speaker or start system.
7. Ability to detect presence or absence of push buttons, touchpad, RJP, Speedlight, speaker or start system.
8. Plate must have self-test capabilities to detect compromised timing bus wire terminations.
9. Junction Boxes (Provided by Electrical Contractor):
    a. In deck system components must fit into a 4" x 4" x 6" PVC junction box.
    b. Conduit interconnects between timing system boxes (deck plates and wall plates) must be PVC. Refer to drawings for sizing.
    c. Verify routing of conduit with timing system manufacturer prior to install.

E. Start System Deck Plate
1. Start system deck plates must be provided as required in the quantities as shown on the drawings.
    a. Basis of Design: Start system deck plates are based upon TITANIUM SERIAL START SYSTEM DECK PLATE as manufactured by Colorado Timing System, Inc.
2. Connection to start system that must provide the following:
    a. Inputs/outputs for start system and speaker.
    b. Detection of presence or absence of speaker input or start system.
    c. Diagnostic capabilities to detect anomalies with connectors (corrosion, shorts) and anomalies with the speaker or start system.
3. Junction Boxes (Provided by Electrical Contractor):
    a. In deck system components must fit into a 4" x 4" x 6" PVC junction box.
    b. Conduit interconnects between timing system boxes (deck plates and wall plates) must be PVC. Refer to drawings for sizing.
    c. Verify routing of conduit with timing system manufacturer prior to install.

F. Timer Deck Plate
1. Timer deck plates must be provided as required in the quantities as shown on the drawings.
    a. Basis of Design: Timer deck plates are based upon TITANIUM SERIAL TIMER DECK PLATE as manufactured by Colorado Timing System, Inc.
2. Connection to timer which must allow for a pool setup without a wall plate, and must provide the following:
    a. Connectivity to timing courses and one scoreboard bus with one cable connection
    b. Detection of presence or absence of connected timer
    c. Diagnostic capabilities to detect anomalies with connectors (corrosion, shorts)
    d. In deck system components must fit into a 4" x 4" x 6" PVC junction box
3. Junction Boxes (Provided by Electrical Contractor):
    a. In deck system components must fit into a 4" x 4" x 6" PVC junction box.

b. Conduit interconnects between timing system boxes (deck plates and wall plates) must be PVC. Refer to drawings for sizing.

c. Verify routing of conduit with timing system manufacturer prior to install.

2.04 SWIMMING TIMING START SYSTEM

A. Swimming Timing Start System (1 required) must be provided to start the automatic swim timing system. The start system must drive speakers mounted under the starting blocks, the relay judging platform strobe lights and deck side start indicators, with microphone.

1. Basis of Design: Swimming Timing Start System is based upon the CHAMPIONSHIP START SYSTEM as manufactured by Colorado Timing System, Inc.

B. System must drive up to twenty 6-watt (reflex) corrosion resistant speakers located under the individual starting blocks as well as be able to drive individual speed lights on each starting block.

C. System must have the capability to use either wired or wireless microphones and must have a volume control on each microphone input.

D. Start system must have a high impact resistant plastic molded enclosure.

E. System must have external connections for additional strobe light, speaker output and start output.

F. The system must run off of an external 12-volt power and have 2 internal gel cell batteries. The internal batteries will automatically be recharged while the starter is plugged in to the external power supply.

G. There must be a LED warning light on the system showing when the internal batteries are starting to get low on power.

H. Starting Block Speaker:

1. Provided one speaker per championship starting block, plus one spare speaker (9 required). Speaker must be mounted on starting platform. Speaker must be corrosion resistant and designed for use in an aquatic environment and rated for such use.

a. Basis of Design: The starting block speaker is based upon the CTS MODEL SP-6/45 as supplied by Colorado Timing System, Inc.

2. The loudspeaker must be a flex driver type horn projector of integrated construction. It must be rated 6 watts for voice or music material with an on-axis frequency response of 320-6000 Hz (“6dB). The sound pressure level must average 97dB(1W/1M) for 500 to 5000 Hz.

3. The horn and mounting base must be tan in color and constructed of impact & UV resistant ABS, which will retain mechanical properties from -20q to +160qF. The driver cone diaphragm must be moisture resistant. Materials must resist damage from extreme weather exposure. Electrical connector must be of 2-conductor banana type, .750 center to center.

4. Provision for mounting must include clearance slots in the adjustable base and hole location points in the horn flange for adapting unit must be recess mounted.

A. Remote Judging Terminal:

1. Interface hub must plug into the PC via USB 2.0 or greater

2. Judges terminals must include a quick release mating connector for connection to the Diving Cable Breakout Box.

3. Judges’ terminals must include rugged communications cable to connect to the diving interface box. Cable should be removable for easy cost-effective replacement of the cable.

4. Judges’ terminals must utilize sealed keyboards with a 128x64 Pixel Backlit LCD display suitable for indoor and sunlight readability.

5. Judges terminal LCD must be capable of displaying Divers Name.

6. Judges terminal LCD must be capable of displaying Divers Team or Country Name.

7. Judges terminal LCD must be capable of displaying scores of other judges once the scores have been accepted.

8. Judges terminal LCD must be capable of displaying Dive and Dive Degree of Difficulty

9. Judges terminal LCD must be capable of displaying the terminal number, so they can be easily identified to the judge

10. Judges terminals must include a request change button to notify the software that the judge's input is requesting permission to correct the submitted score.

11. Judges terminals must be able to be assigned as a Referee's terminal or Assistant Referee's terminal allowing the device to control when the judging data is transmitted to the scoreboard display.

12. Provide five (5) Judging Terminals (JT-01) with associated cables. Provide one interface hub box (IH-01) with associated cables. Provide one (1) cable breakout box (CB-01) with associated cables.

2.05 SWIMMING TIMING COMPONENTS

A. Gutter Hung Touchpads

1. Provide 9 touchpads (9 required, 8 plus 1 spare) to time swimming, in compliance with the appropriate sanctioning body.

   a. Basis of Design: The gutter hung touchpad is based upon the AQUAGRIP GUTTER HUNG TOUCHPAD as manufactured by Colorado Timing System, Inc.

2. Touchpad must be constructed of an all-plastic exterior with only electrical connector metal exposed. Touchpad must be the following dimensions:

   a. (NOTE TO SPECIFIER: Recommended for lanes 7'-0" – 8'-0" wide) Touch pad must be the TP-78G AQUAGRIP, 78" wide x 22" tall x 0.3" thick.

3. Touchpad must have a uniform fine grit and non-abrasive surface that prevents swimmer slippage in any direction.

4. Touchpad markings must have contrasting colors with a 2" black border and black end-wall cross pattern for portion covered by touchpads.

5. Touchpad brackets must be custom made to fit the pool. Contractor to provide sufficient number of brackets for support of each touchpad.

   a. Contractor to provide an additional 2 spare touchpad brackets.

6. Touchpad must have a two-year warranty without a requirement to purchase a protective touchpad cart.

7. Touchpad caddy for storing the number of touch pads supplied must be CAD-TP/P.

B. Push Buttons

1. Provide two (2) back-up buttons for each touchpad provided.

2. Back-up buttons must be plunger style button with a 5' cable.

C. Swimming Timing Systems Caddies

1. Provide touchpad caddy for storing touch pads. The correct number of touchpad caddies must be supplied to store touchpads. Caddy must be sized to match timing system touch pad widths. Touchpad caddy must consist of an aluminum frame with four freewheeling casters. The

CONTRACTOR is responsible for assembly. Touchpad caddy must be CAD-TP as manufactured by Colorado Timing Systems, Inc.

3.01 EXISTING CONDITIONS

A. Verify that work by others, related to this section, is installed.

B. Carefully examine the construction documents that affect the work of this section.

C. Prior to starting work, notify the Architect and General Contractor of defects requiring correction.

D. Protect other materials and installed work against damage while completing work in this section.

3.02 INSTALLATION

A. Provide custom cables, connecters, scoreboard mounting brackets, and fasteners.

B. Provide scaffolding and labor for mounting scoreboard and pulling cables.

C. Provide equipment in accordance with the manufacturer's drawings and instructions.

D. Provide scoreboard mounting, timing system cable terminations, system checkout, and local operator training at time of installation. Training must consist of one 4-hour session.

E. Provide as-built drawings precisely locating items.

F. Wiring and grounding must be installed in strict accordance with the latest edition of the National Electric Code – Article 680.

END OF SECTION 131106

SECTION 142400 - ELEVATORS - MACHINE ROOM-LESS HYDRAULIC PASSENGER ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes Machine room-less hydraulic passenger elevators as shown and specified. Elevator work includes:
   1. Standard pre-engineered hydraulic passenger elevators.
   2. Elevator car enclosures, hoist way entrances and signal equipment.
   3. Operation and control systems.
   4. Jack(s).
   5. Accessibility provisions for physically disabled persons.
   6. Equipment, machines, controls, systems, and devices as required for safely operating the specified elevators at their rated speed and capacity.
   7. Materials and accessories as required to complete the elevator installation.

B. Related Sections:
   1. Division 1 General Requirements: Meet or exceed all referenced sustainability requirements.
   2. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
   3. Division 4 Masonry: Installing inserts, sleeves and anchors in masonry.
   4. Division 5 Metals:
      a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
      b. Providing steel angle sill supports and grouting hoist way entrance sills and frames.
   5. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
   6. Division 16 Sections:
      a. Providing electrical service to elevators, including fused disconnect switches where permitted. (note: fused disconnect switch to be provided as part of elevator manufacture product, see section 2.11 Miscellaneous elevator components for further details.)
      b. Emergency power supply, transfer switch and auxiliary contacts.
      c. Heat and smoke sensing devices.
      d. Convenience outlets and illumination in control room (if applicable), hoist way and pit.
   7. Division 22 Plumbing
      a. Sump pit and oil interceptor.
   8. Division 23 Heating, Ventilation and Air Conditioning
      a. Heating and ventilating hoist ways and/or control room.

C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent. The cost of this work is not included in the TK Elevator’s proposal since it is a part of the building construction.

1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
3. Hatch walls require a minimum of two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
4. Elevator hoistways shall have barricades, as required.
5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. All wire and conduit should run remote from the hoistways.
10. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
11. Install and furnish finished flooring in elevator cab.
12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained when drywall construction is used.
13. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
14. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
15. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
16. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
17. The General Contractor shall fill and grout around entrances, as required.
18. All walls and sill supports must be plumb where openings occur.
19. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
20. Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Typically this will be at the landing above the 1st floor. Final location must be coordinated with elevator contractor.
21. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway.
22. For signal systems and power operated door: provide ground and branch wiring circuits.

23. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
24. Controller landing wall thickness must be a minimum of 8 1/2 inches thick. This is due to the controller being mounted on the second floor landing in the door frame on the return side of the door. For center opening doors, the controller is located on the right hand frame (from inside the elevator cab looking out). These requirements must be coordinated between the general contractor and the elevator contractor.
25. Cutting, patching and recesses to accommodate hall button boxes, signal fixtures, etc..

1.02 SUBMITTALS

A. Product data: When requested, the elevator contractor shall provide standard cab, entrance and signal fixture data to describe product for approval.

B. Shop drawings:
   1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
   2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
   3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
   4. Indicate electrical power requirements and branch circuit protection device recommendations.

C. Powder Coat paint selection: Submit manufacturer's standard selection charts for exposed finishes and materials.

D. Plastic laminate selection: Submit manufacturer's standard selection charts for exposed finishes and materials.

E. Metal Finishes: Upon request, standard metal samples provided.

F. Operation and maintenance data. Include the following:
   1. Owner's manuals and wiring diagrams.
   2. Parts list, with recommended parts inventory.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.
   1. The manufacturer of machines, controllers, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.
      a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.
   2. The manufacturer shall have a documented, on-going quality assurance program.
   3. ISO-9001:2000 Manufacturer Certified
   4. ISO-14001:2004 Environmental Management System Certified

B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.

C. Regulatory Requirements:
   1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
   2. Building Code: National.
   3. NFPA 70 National Electrical Code.
   4. NFPA 80 Fire Doors and Windows.
   5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
   6. Section 407 in ICC A117.1, when required by local authorities
   7. CAN/CSA C22.1 Canadian Electrical Code
   8. CAN/CSA B44 Safety Code for Elevators and Escalators.
   9. California Department of Public Health Standard Method V1.1–2010, CA Section 01350

D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

E. Inspection and testing:

   1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
   2. Arrange for inspections and make required tests.
   3. Deliver to the Owner upon completion and acceptance of elevator work.

F. Sustainable Product Qualifications:
   1. Environmental Product Declaration:
      a. GOOD: If Product Category Rules (PCR) are not available, produce a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
      b. BEST: If Product Category Rules (PCR) are available, produce and publish an Environmental Product Declaration (EPD) based on a critically reviewed life-cycle assessment conforming to ISO 14044, with external verification recognized by the EPD program operator.
   2. Material Transparency:
      a. GOOD: Provide Health Product Declaration at any level
      b. BETTER: Provide Health Product Declaration (HPD v2 or later). Complete, published declaration with full disclosure of known hazards, prepared using the Health Product Declaration Collaborative's "HPD builder" on-line tool.
      c. BEST: Cradle to Cradle Material Health Certificate v3, Bronze level or higher.
   3. LEED v4 – Provide documentation for all Building Product Disclosure AND Optimization credits in LEED v4 for product specified.
   4. Living Building Challenge Projects: Provide Declare label for products specified.

1.04 DELIVERY, STORAGE AND HANDLING

A. Manufacturing shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.05 PROJECT CONDITIONS

A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

1.06 WARRANTY

A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after final acceptance.

1.07 MAINTENANCE

A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.
   1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
   2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
   3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Design based around TK Elevator’s endura Machine Room-Less hydraulic elevator.

2.02 MATERIALS, GENERAL

A. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD, and shall meet the California Department of Public Health Standard Method V1.1–2010, CA Section 01350 as mentioned in 1.03.9 of this specification.

B. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.

C. Steel:
   1. Shapes and bars: Carbon.
   2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
   3. Finish: Factory-applied powder coat for structural and architectural parts. Color selection must be based on elevator manufacture's standard selections.

D. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture's standard selections.

E. Flooring by others.

2.03 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.

D. Guides: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to ensure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless. Two jacks piped together, mounted one on each side of the car with a polished steel hydraulic plunger housed in a sealed steel casing having sufficient clearance space to allow for alignment during installation. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..

G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper grade inherently biodegradable oil as specified by the manufacturer of the power unit (see Power Unit section 2.04.G for further details)

I. Pit moisture/water sensor located approximately 1 foot above the pit floor to be provided. Once activated, elevator will perform "flooded pit operation", which will run the car up to the designated floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.

J. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Also a means for manual operation at the valve in the pit is required.

2.04 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:
   1. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather
   2. An oil hydraulic pump.
   3. An electric motor.
   4. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.

B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating – motors shall be capable of 80 starts per hour with a 30% motor run time during each start.

D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
   1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
   2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
   3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.

4. The lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
5. Provided with constant speed regulation in both up and down directions. Feature to compensate for load changes, oil temperature, and viscosity changes.
6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
7. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)
8. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.05 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
   1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
   2. Main landing door & frame finish: Stainless steel panels, no. 4 brushed finish with no. 4 brushed finish entrance frame.
   3. Typical door & frame finish: Stainless steel panels, no. 4 brushed finish with no. 4 brushed finish entrance frame.

B. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1st landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See section 2.09 Control System for additional requirements.

C. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See section 2.11 Miscellaneous Elevator Components for further details.

D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.

E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
   1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
   2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
   3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.06 PASSENGER ELEVATOR CAR ENCLOSURE

A. Car Enclosure:
   1. Walls: Cab type TKS, reinforced cold-rolled steel. Walls shall be constructed of 5WL rigidized stainless steel.
   2. Reveals and frieze: Not Applicable
   3. Canopy: Cold-rolled steel with hinged exit.
   4. Ceiling: Downlight type, metal pans with suspended LED downlights and dimmer switch. Number of downlights shall be dependent on platform size with a minimum of six. The metal pans shall be finished with a stainless steel, no. 4 brushed finish.
   5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel.
   6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
      a. Door Finish: Stainless steel panels: No. 4 brushed finish.
      b. Cab Sills: Extruded aluminum, mill finish.
   7. Handrail: Provide 2' flat metal bar on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, no. 4 brushed finish.
   8. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.
   9. Protection pads and buttons: Provide one set of vinyl protection pads with metal grommets for the project. Provide pad buttons on cab front(s) and walls.

B. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.07 DOOR OPERATION

A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.08 CAR OPERATING STATION

A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED’s shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

B. Emergency Communications System: Integral phone system provided.

C. Auxiliary Operating Panel:

D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

E. Special Equipment:
Limited Access Operation: Keyswitch and card reader space.(card reader by others)

2.09 CONTROL SYSTEMS

A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

B. Service Panel – to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:
1. Access to main control board and CPU
2. Main controller diagnostics
3. Main controller fuses
4. Universal Interface Tool (UIT)
5. Remote valve adjustment
6. Electronic motor starter adjustment and diagnostics
7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit
8. Operation of auxiliary pump/motor (secondary hydraulic power source)
9. Operation of electrical assisted manual lowering
10. Provide male plug to supply 110VAC into the controller
11. Run/Stop button

C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

D. Emergency Power Operation: (10-D-OC) Battery lowering .

E. Special Operation:
Limited Access Operation: A key switch shall be provided to initiate the Limited Access Operation. The activation of this operation shall restrict the operation of the elevator car calls to selected floors on a per-floor, per elevator basis. Travel to the restricted floors shall be allowed after the entry of the required access code via a card reader device supplied by others. The card reader entry shall override the car call restrictions and allow entry of a car call to a restricted floor.

2.10 HALL STATIONS

A. Hall Stations, General: Vandal resistant buttons with center jewels which illuminate to indicate that a call has been registered at that floor for the indicated direction. Each button shall be provided with an internal automatic stop to prevent damage of switches that register the call. Provide 1 set of pushbutton risers. All fixtures shall be vandal resistant type.
    1. Provide one pushbutton riser with faceplates having a brushed stainless steel finish.
        a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.

B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

C. Hall Position Indicator: Not Applicable

D. Hall lanterns: Not Applicable

E. Special Equipment: Not Applicable

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.

B. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.

C. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code

PART 3 EXECUTION

3.01 EXAMINATION

A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

A. Install elevator systems components and coordinate installation of hoistway wall construction.
   1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
   2. Comply with the National Electrical Code for electrical work required during installation.

B. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.

C. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.

D. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.

E. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

F. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.

G. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

H. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.

I. Lubricate operating parts of system, where recommended by manufacturer.

3.03 FIELD QUALITY CONTROL

A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.

B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.04 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.05 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.

B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
   1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.06 PROTECTION

A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.07 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

3.08 ELEVATOR SCHEDULE

A. Elevator Qty. 1
   1. Elevator Model: endura MRL Twinpost above-ground 1-stage
   2. Elevator Type: Hydraulic Machine Room-Less, Passenger
   3. Rated Capacity: 4500 lbs.
   4. Rated Speed: 110 ft./min.
   5. Operation System: TAC32H
   6. Travel: 13'-4"
   7. Landings: 2 total

8. Openings:
    a. Front: 2
    b. Rear: 0
9. Clear Car Inside: 5'-8" wide x 7'-9 1/2" deep
10. Inside clear height: 7'-4" standard
11. Door clear height: 7'-0" standard
12. Hoistway Entrance Size: 4'-0" wide x 7'-0" high
13. Door Type: Two-speed | LH Side opening
14. Power Characteristics: 208 volts, 3 Phase, 60 Hz.
15. Seismic Requirements: No
16. Hoistway Dimensions: 7'-4" wide x 10'-0 1/2" deep
17. Pit Depth: 5'-0"
18. Button & Fixture Style: Vandal Resistant Signal Fixtures
19. Special Operations:
    Limited Access with card readers by others

B. Elevator Qty. 1
1. Elevator Model: endura MRL Twinpost above-ground 1-stage
2. Elevator Type: Hydraulic Machine Room-Less, Passenger
3. Rated Capacity: 5000 lbs.
4. Rated Speed: 100 ft./min.
5. Operation System: TAC32H
6. Travel: 13'-4"
7. Landings: 2 total
8. Openings:
    a. Front: 2
    b. Rear: 2
9. Clear Car Inside: 5'-8" wide x 8'-5" deep
10. Inside clear height: 7'-4" standard
11. Door clear height: 7'-0" standard
12. Hoistway Entrance Size: 4'-6" wide x 7'-0" high
13. Door Type: Two-speed | LH Side opening
14. Power Characteristics: 208 volts, 3 Phase, 60 Hz.
15. Seismic Requirements: No
16. Hoistway Dimensions: 8'-4" wide x 11'-4 ¾"" deep
17. Pit Depth: 5'-0"
18. Button & Fixture Style: Vandal Resistant Signal Fixtures

Special Operations:
Limited Access with card readers by others

3.09 SUBSTITUTIONS

Or approved equal with matching quantities, finishes, accessories & warranties.

END OF SECTION

SECTION 210400 - GENERAL CONDITIONS FOR FIRE PROTECTION TRADES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

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

B. This section applies to certain sections of Division 26, "Electrical," and this section applies to all sections of Division 21, "Fire Protection" of this project specification unless specified otherwise in the individual sections.

C. The Drawings of other trades (Architectural, Food Service, Structural, Landscape, Civil, Mechanical, Plumbing, Electrical, Communications and Fire Alarm) shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

1.2 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division. Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

1.3 INTENT

A. It is the intent of the Specifications and Drawings to call for finished work, tested and ready for operation.

B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation as determined by good trade practice even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.

C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws,

ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section includes the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

1.4 DEFINITIONS

A. "Approved equal" also known as "alternative" mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.

B. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

C. "Finished" refers to all rooms and areas to be specified to receive architectural treatment as indicated on the drawings. All rooms and areas not covered, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

D. "Furnish" or "supply" shall mean purchase, deliver to, and off-load at the job site, ready to be installed including where appropriate all necessary interim storage and protection.

E. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

F. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

G. "Install" shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.

H. "Lead Free" shall mean not more than .25% in the wetted surface area.

I. "Product" shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

J. "Provide" shall mean furnish (or supply) and install as necessary.

K. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

L. Remove: The term "remove" means "to disconnect from its present position, remove from the premises and to dispose of in a legal manner."

M. Special Warranties: The term "Special Warranties" are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

N. Standard Product Warranties: The term “Standard Product Warranties” are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

O. “Subcontractor” means specifically the subcontractor working under this Division. Other Contractors are specifically designated “Fire Protection Subcontractor”, “General Contractor” and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.

P. Substitutions: Requests for changes in products, materials, equipment, and methods of construction proposed by the Contractor are considered requests for "substitutions."

Q. “Wiring” shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

1.5 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)

B. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.

C. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

D. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.

1.6 SURVEYS AND MEASUREMENTS

A. 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 the site and check the correctness of same as related to the work.

B. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or which interfere with the intent of the Drawings and Specifications, the Engineer will be notified and work will not proceed until instructions from the Engineer are received.

1.7 CODES AND STANDARDS

A. Reference Standard Compliance

1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.
2. Independent Testing Organization Certificate: In lieu of the label or listing indicated above, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. The Following Codes and Standards listed below apply to all Fire Protection work. Wherever Codes and/or Standards are mentioned in these Specifications, the latest applicable edition or revision shall be followed:
Florida Building Code 2020 Including all Supplements

Florida Fire Prevention Code 2020 Including all Supplements

NFPA 13, Standard for Installation of Sprinkler Systems

NFPA 70, the National Electrical Code

NFPA 101, the Life Safety Code

ASHRAE 90.1 and Florida Energy Conservation Code

C. The following Standards shall be used where referenced by the following abbreviations:

AIA	American Institute of Architects
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society of Testing and Materials
AWS	American Welding Society
CISPI	Cast Iron Soil Pipe Institute
EJMA	Expansion Joint Manufacturing Association
EPA	Environmental Protection Agency
FM	Factory Mutual

FSSC	Federal Specification
HIS	Hydraulic Institute Standards
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
ISO	Insurance Services Office
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSC	National Safety Council
OSHA	Occupational Safety and Health Administration
UL	Underwriters' Laboratories

D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.8 PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the work, file all necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.9 EQUIPMENT SUBSTITUTIONS

A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of workmanship, finish and design that is required. If the Contractors uses an "approved equal" alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.

B. Where one name only is used and is followed by the words “or approved equal”, the Contractor must use the item named or he is required to apply for a substitution. Where one name only is used, the Contractor must use that item named.

C. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.

D. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical, plumbing, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.

E. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non approved equivalent to that specified and the amount of credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer’s equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

F. If an alternative or substitute item results in a difference in quantity and arrangement of piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.

G. .Equipment, material or devices submitted for review as an “equivalent” shall meet the following requirements:
   1. The equivalent shall have the same construction features such as, but not limited to:
      a. Material thickness, gauge, weight, density, etc.
      b. Welded, riveted, bolted, etc., construction
      c. Finish, undercoating, corrosion protection
   2. The equivalent shall perform with the same or better operating efficiency.
   3. The equivalent shall be locally represented by the manufacturer for service, parts and technical information.
   4. The equivalent shall bear the same labels of performance certification as is applicable to the specified item, such as UL or NEMA labels.

H. Equipment, material or devices submitted for review as a “substitution” shall meet the following requirements:
   1. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.
   2. Submit three (3) copies of each request for substitution for consideration.

3. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
    a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
    b. Samples, where applicable or requested.
    c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
    d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
    e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
    f. Cost information, including a proposal of the net change, if any in the Contract Sum.
    g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
    h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.
    i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.
        1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.
        2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
        3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.10 SUBMITTAL PROCEDURES

A. Provide Submittals in accordance with the requirements of Division 01 and as indicated in the following.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
   1. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
   2. If an intermediate submittal is necessary, process the same as the initial submittal.
   3. Allow two weeks for reprocessing each submittal.
   4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block. Submittals shall be arranged in order of specification sections.
   1. Include the following information on the label for processing and recording action taken.
      a. Project name.
      b. Date.
      c. Name and address of Engineer.
      d. Name and address of Contractor.
      e. Name and address of subcontractor.
      f. Name and address of supplier.
      g. Name of manufacturer.
      h. Number, title and paragraph of appropriate Specification Section.
      i. Drawing number and detail references, as appropriate.

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

F. Except for submittals for record, information or similar purposes, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.

G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.

1.11 SHOP DRAWINGS

A. Submit neatly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated sprinkler layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review copies of all shop drawings to be incorporated in the Fire Protection Contract. Refer to Division 01 for the quantity of copies required for submission. Where quantities are not specified, provide seven (7) copies for review.

C. Provide shop drawings for all devices specified under equipment specifications for all systems. Shop drawings shall include manufacturers' names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures), of all shop drawings, performance cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.

D. When a submittal could involve more than one trade, e.g., valves, piping, etc., the submitted shall be separated by traded involved, ie. HVAC, plumbing, electrical, etc.

E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.

F. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

G. "No Exception Taken" rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings. Review of shop drawings shall not apply to quantity of material.

H. After shop drawings have been reviewed, with no exceptions taken, no further changes will be allowed without the written consent of the Engineer.

I. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

J. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to Bidding to allow for issuance of an Addendum.

K. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

1.12 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 01 to a minimum scale of 1/4"=1'-0" detailing major elements, components, and systems of fire protection 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. The Contractor shall indicate the proposed locations of piping, conduit, ductwork, equipment, and materials. Include the following:
      a. Clearances for servicing and maintaining equipment and space for equipment disassembly required for periodic maintenance.
      b. Equipment connections and support details.
      c. Exterior wall and foundation penetrations.
      d. Fire-rated wall and floor penetrations.
      e. Sizes and locations of required concrete pads and bases.

B. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

D. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

E. The Contractor and each subcontractor shall sign and date each coordination drawing prior to submission.

F. Work shall not be performed until coordination drawings have been approved by the architect and engineer.

G. Electronic copies of the MEP floor plans are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. The Contractor must file an Electronic Drawing File Release Form. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic Drawing File Release Form, the Engineer will provide copies of the electronic files for the Contractor's use. A copy of the Electronic Drawing File Release Form is appended to the end of this specification section

1.13 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, HVAC piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

1.14 WORKMANSHIP

A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled workmen, fitters, metal workers, welders, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

E. All labor for installation of Fire Protection systems shall be performed by experienced, skilled tradesmen under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, workmanlike manner. The Engineer reserves the right to reject any work which, in his opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.15 TEMPORARY UTILITIES

A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

C. First Aid Supplies: Comply with governing regulations.

D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

E. Utilities: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
   1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.

F. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

G. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

H. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.16 PROJECT PHASING

A. Work under each Section shall include all necessary temporary connections, equipment, piping, heating, temperature control work, fire stopping, water heaters, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required

to maintain existing systems operational or to accommodate the construction phasing of the project.

1.17 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or workmen and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by workmen or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.18 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer’s recommendations and is operating as intended by the manufacturer.

1.19 CLEANING

A. The Contractor shall thoroughly clean and flush all piping and equipment of all foreign substances, oils, burrs, solder, flux, etc., inside and out before being placed in operation.

B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. During the course of construction, all pipes shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work. Any oil or grease stains on floor areas caused by the Contractor shall be removed and floor areas left clean.

E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
   1. Remove labels that are not permanent labels.
   2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
   3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
   4. Wipe surfaces of fire protection equipment. Remove excess lubrication and other substances.

F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material, skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.

G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

1.20 OPERATING AND MAINTENANCE

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall fully instruct the Owner or the Owner’s representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) days notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.

C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

D. An authorized manufacturer’s representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. The following equipment will require this inspection: pumps; controls, water heaters, compressors, boilers etc. These letters shall be bound into the operating and maintenance books.

E. Refer to individual trade Sections for any other particular requirements related to operating instructions.

F. Demonstration shall be recorded on (2) USB Flash drives and be turned over to the Owner.

1.21 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with the requirements of Division 01 and as follows. The Contractor shall prepare six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-ring vinyl-covered binders, with pocket folders for folded sheet information and designation partitions with identification tabs. Mark appropriate identification on front and spine of each binder.

B. Manual shall include the following:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing and operating instructions including lubrication charts and schedules.
5. Emergency and safety instructions.
6. Spare parts list.
7. Copies of warranties.
8. Wiring diagrams.
9. Recommended "turn around" cycles.
10. Inspection procedures.
11. Approved Shop Drawings and Product Data.
12. Equipment Start-up Reports.

C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, bearing number, etc. Schedule shall include maintenance to be done and frequency.

D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.

1.22 ACCEPTANCES

A. The equipment, materials, workmanship, design and arrangement of all work installed under the Fire Protection Sections shall be subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, the Fire Protection Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Fire Protection Sections. The intent to use the exact manufacturers and

models specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of award of the Contract. In such instances, equipment substitutions may be made pending acceptance by the Engineer or the Owner's representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Fire Protection Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.23 RECORD DRAWINGS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Items to be indicated include but are not limited to:

1. Dimensional change
2. Revision to drawing detail
3. Location and depth of underground utility
4. Revision to pipe routing
5. Revision to electrical circuitry
6. Actual equipment location
7. Pipe size and routing
8. Location of concealed internal utility
9. Changes made by Change Order
10. Details not on original Contract Drawing
11. Information on concealed elements which would be difficult to identify or measure later

C. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

D. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

E. Note related Change Order numbers where applicable.

F. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

G. Final record documents shall be prepared in the latest AutoCAD or Revit version and CD Rom of all drawings and a clean set of reproducible paper copies shall be turned over to the Owner at the completion of the work.

1.24 WARRANTIES AND BONDS

A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties are to be included:
   1. General close-out requirements included in Division 01.
   2. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions-02 through -50.
   3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.25 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise

available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.
   1. Refer to individual Sections of Divisions-02 through -50 for specific content requirements, and particular requirements for submittal of special warranties.

J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
   1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
   2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.
   3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.26 GUARANTEES

A. The Contractor shall guarantee all material and workmanship under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner.

During this guarantee period, all defects developing through faulty equipment, materials or workmanship shall be corrected or replaced immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineer's satisfaction.

B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided.

1.27 PROJECT CLOSE-OUT

A. Contractor shall submit annual maintenance proposal to the Architect/Engineer for review and approval as part of the close out documents.

B. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents in accordance with Division 01.

C. Deliver tools, spare parts, extra stock, and similar items.

D. Complete start-up testing of systems, including measuring and documenting all required startup checklist requirements documented in installation and maintenance instructions by the equipment manufacturer, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

E. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

F. Field Observation Procedures: On receipt of a request for an Engineers Field Observation, the Engineer will advise the Contractor of unfulfilled requirements. The Engineer will advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
   1. The Engineer will repeat the Field Observation when requested and assured that the Work has been substantially completed.
   2. Results of the completed list of unfulfilled items will form the basis of requirements for final acceptance.

END OF SECTION

Electronic Drawing File Release Form

DELIVERY OF ELECTRONIC FILES FOR: _____
Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Contractor covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Contractor further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Contractor agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys' fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____ _____
Contractor's Signature Date

_____
Company - Title

_____ _____
Architects' Signature Date

_____
Firm - Title

_____ _____
Owner's Signature Date

_____
Company - Title

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes pipe, fittings, valves, backflow preventers and connections for [sprinkler] systems.

B. Related Sections:
1. Division 01- General Requirements
2. Division 03 - Concrete.
3. Division 09 - Finishes.
4. Section 21 05 16 – Expansion Fittings and Loops for Fire-Suppression Piping.
5. Section 21 13 13 – Wet-Pipe Sprinkler System.
6. Section 23 04 00 – General Conditions for Mechanical Trades

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
2. ASME B16.3 – Malleable Iron Threaded Fittings, Class 150 and 300.
3. ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
4. ASME B16.5 - Pipe Flanges and Flanged Fittings
5. ASME B16.9 – Factory-made Wrought Steel Butt Welding Fittings.
6. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
7. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
8. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
9. ASME B16.25 – Butt Welding Ends.
10. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
11. ASME Sec 9 - Welding and Brazing Qualifications.

B. ASTM International:
1. ASTM A47 – Malleable Iron Castings.
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
4. ASTM A126 – Standard for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
5. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
6. ASTM A536 – Standard for Ductile Iron Casting.
7. ASTM A795 - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
8. ASTM B32 - Standard Specification for Solder Metal.
9. ASTM B75 - Standard Specification for Seamless Copper Tube.
10. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
11. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.

12. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
13. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
14. ASTM F442 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
15. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.
3. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.

D. American Water Works Association:
1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
5. AWWA C510 – Standard for Double Check Valve Backflow Prevention Assembly.
6. AWWA C511 – Standard for Reduced Pressure Principal Backflow Prevention Assembly.
7. AWWA C606 – Standard for Grooved and Shouldered Joints.

E. National Fire Protection Association:
1. NFPA 10 - Portable Fire Extinguishers.
2. NFPA 13 - Installation of Sprinkler Systems.
3. NFPA 13D – Installation of Sprinkler Systems in One and Two Family Dwellings and Mobile Homes
4. NFPA 13R – Standard for Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height.
5. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.
6. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.

F. Underwriter Laboratories, Inc.:
1. UL 1887 - Fire Tests of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.
2. UL - Fire Resistance Directory.

G. Factory Mutual:
1. FM - Factory Mutual Approval Guide.

1.3 SUBMITTALS

A. Division 01 - General Requirements.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Product Data: Submit manufacturer's catalogue information. Provide data on valves, and fittings, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

D. Grooved joint couplings and fittings shall be shown on shop drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series designation.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and all code requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - General Requirements.

B. Project Record Documents: Record actual locations of components and tag numbering.

C. Operation and Maintenance Data: Submit spare parts lists.

1.5 QUALITY ASSURANCE

A. Workmanship and Qualifications: All materials and equipment shall be installed in accordance with NFPA and all applicable local codes and ordinances. The Sprinkler Contractor shall be state licensed to install sprinkler systems. The Sprinkler Contractor shall make sure that all work and materials conform to the requirements set forth by this Specification. Fire protection equipment shall be installed to conform to NFPA as applicable, and devices used shall be listed and approved by Underwriters laboratories (UL) and/or Factory Mutual (FM).

B. Codes and Standards: All work shall be equal or superior to that required by codes, regulations, ordinances, and laws imposed by the jurisdictional authorities, including those of the State, State Fire Marshall, local ordinances, Underwriter's Requirements and OSHA. Nothing in the Specifications permit violations of such directives, and where conflict occurs, the directive shall govern, except where superior work is specified or indicated.

C. In addition to complying with the above codes and regulations, comply with the requirements of the following:
   1. NFPA Standard 13.
   2. NFPA Standard 72.
   3. State Building and Fire Codes.
   4. Local Jurisdictional Authorities.

D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

E. Valves: Bear UL and/or FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

F. All items of similar class shall be the products of the same manufacturer. All valves, accessory items, etc., shall be from the same source.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum five years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - General Requirements.

B. Deliver and store valves in shipping containers, with labeling in place.

C. Furnish cast iron and steel valves with temporary protective coating.

D. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. All equipment, valves, gages and etc., shall be covered and protected during the execution of the work. All equipment and piping shall be protected from freezing. Labeling to remain in place.

F. All unloading, hauling, and handling of materials shall be the responsibility of the Sprinkler Contractor.

G. The Sprinkler Contractor can obtain information on available storage space on site from the Owner when making examination of the site.

1.8 WARRANTY

A. Division 01 - General Requirements.

1.9 EXTRA MATERIALS

A. Division 01 - General Requirements.

B. Furnish two sets of valve stem packing for each size and type of valve installed.

PART 2 PRODUCTS

2.1 VALVES

A. Manufacturers:
1. Kennedy Valve Mfg. Co.
2. Victaulic.
3. Stockham.
4. Nibco.

5. Watts.
6. Hammond.
7. Milwaukee.
8. Substitutions: Division 01 - General Requirements.

B. Gate Valves:
1. Up to and including 2 inches: Bronze body and trim, 175 lb, cold water non-shock working pressure, rising stem, hand wheel, solid wedge or disc, threaded ends.
2. Over 2 inches: Iron body, bronze trim, 175 lb, cold water non-shock working pressure, rising stem pre-grooved for mounting tamper switch, hand wheel, outside screw and yoke, solid taper bronze or cast iron wedge, grooved or flanged ends.
3. Over 4 inches: Iron body, bronze trim, 175 pound cold water, non-shock working pressure. Valve shall have solid taper wedge; outside screw and yoke, rising stem; flanged bonnet with body and bonnet conforming to ASTM A126 Class B; replaceable bronze wedge facing rings; grooved or flanged ends; and a packing assembly consisting of a cast iron gland flange, brass gland, packing, bonnet and bronze bonnet bushing. Valve shall be capable of being repacked under pressure, with valve wide open.

C. Globe Valves:
1. Up to and including 2 inches: Class 125, Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable rubber disc, threaded ends, with back seating capacity, packable under pressure.
2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

D. Angle Valves:
1. Up to and including 2 inches: Class 125, Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable rubber disc, threaded ends, with back seating capacity, packable under pressure.
2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

E. Ball Valves:
1. Up to and including 2 inches: Bronze two piece body, standard port, chrome plated brass ball, 316 stainless steel stem, teflon seats brass stem nut, die-cast brass gear box with supervisory switches, threaded or grooved ends.
2. Over 2 inches: Manufacturers: Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle.

F. Butterfly Valves:
1. Ductile iron body, ductile iron disc with EPDM disc coating and integrally cast stem, grooved ends.
2. Cast bronze body, ductile iron disc with EPDM disc coating and integrally cast stem, copper-tubing dimensioned grooved ends.
3. Cast iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck with 316 stainless steel stem, MSS-SP-67, 200 psi.
4. Disc: EPDM coated ductile iron or Aluminum bronze.
5. Operator: Notched plate lever handle, Handwheel and Weatherproof Actuator with supervisory switches.

G. Check Valves:
   1. Up to and including 2 inches: Class 125, Bronze swing disc, screwed ends.
   2. Horizontal Swing Over 2 inches:
      a. 300 psi CWP, ductile iron body and coupled cap conforming to ASTM A536, Grade 65-45-12; horizontal swing, with stainless steel disc, elastomer seat, and grooved ends.
      b. Class 175, cast iron body and bolted cap conforming to ASTM A126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends.
      c. Valve shall be capable of being refitted while the valve remains in line.
   3. Spring Actuated Over 2 inches:
      a. 300 psi CWP, ductile iron body conforming to ASTM A536, Grade 65-45-12; vertical or horizontal check; with stainless steel spring and shaft.
         1) 2-1/2 (65 mm) and 3 inches (75 mm): Aluminum bronze disc with disc mounted elastomer seal and PPS (Polyphenylene Sulfide) coated seat.
         2) 4 inches (100 mm) and Larger: Elastomer coated ductile iron disc with welded-in nickel seat.

H. Drain Valves:
   1. Compression Stop: Bronze with hose thread nipple and cap.
   2. Ball Valve: Brass with cap and chain, 3/4 inch hose thread.

I. All valves shall be either UL listed or FM approved for use on fire protection systems.

2.2 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 13.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp or Angle ring.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate work of this Section with other affected work.

B. Ream pipe and tube ends. Remove burrs. [Bevel plain end ferrous pipe.]

C. Remove scale and foreign material, from inside and outside, before assembly.

D. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION – GENERAL

A. Install in accordance with manufacturer's instructions.

B. The Contractor shall maintain a clean and orderly site during the installation of the sprinkler system. Materials shall not be stored in the halls or other public areas.

C. Cutting, welding and other hot work shall not be permitted without permission from the building owner. Contractor shall provide a fire watch for one hour after all welding.

D. The required tests shall be witnessed by the Fire Marshall, authority having jurisdiction, Owner's insurance underwriter and Architect/Engineer.

E. Pipe Hangers and Supports:
1. Install in accordance with NFPA 13.
2. Install hangers to with minimum 1/2 inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.
7. Prime coat exposed steel hangers and supports. [Refer to Section 09 90 00.] Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.3 INSTALLATION – PIPE AND FITTINGS, UNDERGROUND

A. Install pipe and fittings in accordance with the requirements of NFPA 13 and NFPA 24

B. Install pipe and fittings in accordance with manufacturer's recommendations

C. In areas where frost is a factor, depth of cover for underground piping shall be as indicated on the plans and in accordance with the recommended depth of cover indicated in NFPA 13, figure A.10.4.1

D. In areas where frost is not a factor, the depth of cover shall be not less than 2½ ft to prevent mechanical damage.

E. Pipe under driveways shall be buried a minimum of 3 ft.

F. The depth of cover shall be measured from the top of the pipe to finished grade, and due consideration shall always be given to future or final grade and nature of soil.

G. Pipes shall bear throughout their full length and shall not be supported by the bell ends only or by blocks.

H. All tees, plugs, caps, bends, reducers, valves, and hydrant branches shall be restrained against movement by using thrust blocks in accordance with NFPA 13.

I. On steep grades, mains shall be additionally restrained to prevent slipping.

J. Pipe shall be restrained at the bottom of a hill and at any turns (lateral or vertical).

K. Backfilling.
1. Underground piping shall not be buried until all piping has been flushed and hydrostatically pressure tested in accordance with the acceptance requirements indicated below.
2. Backfill shall be tamped in layers or puddled under and around pipes to prevent settlement or lateral movement and shall contain no ashes, cinders, refuse, organic matter, or other corrosive materials.
3. Rocks shall not be placed in trenches.
4. Frozen earth shall not be used for backfilling.
5. In trenches cut through rock, tamped backfill shall be used for at least 6 in. under and around the pipe and for at least 2 ft above the pipe.

L. Acceptance requirements
1. Underground piping shall be flushed in accordance with the requirements of NFPA 13.
2. All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested, in accordance with NFPA 13, at 200 psi or 50 psi in excess of the system working pressure, whichever is greater, and shall maintain that pressure ±5 psi for 2 hours

3.4 INSTALLATION – PIPE AND FITTINGS ABOVE GROUND

A. Install piping in accordance with NFPA 13 for sprinkler systems.

B. Pipe and fitting shall be installed per the manufacture's installation requirements. The fire protection contractor shall furnish all materials necessary to meet these requirements including but not limited to hangers, support, insulation, shields, sleeves and power supplies.

C. Place piping in concealed spaces above finished ceilings unless noted otherwise.

D. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

E. Install piping to conserve building space, to not interfere with use of space and other work.

F. Pipe and fitting shall be installed per the manufacture's installation requirements. The fire protection contractor shall furnish all materials necessary to meet these requirements including but not limited to hangers, support, insulation, shields, sleeves and power supplies.

G. Group piping whenever practical at common elevations.

H. Install pipe sleeve at piping penetrations through partitions, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Use Victaulic Style 77 or 75 couplings in accordance with Victaulic instructions for expansion and contraction of pipe.

J. Grooved joint couplings and fittings shall be installed in accordance with the manufacturer's written installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.

K. Pitch piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

L. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Section 09 90 00.

M. Do not penetrate building structural members unless indicated.

N. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.

O. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

P. Provide dielectric fittings whenever joining two dissimilar metals.

Q. Provide surge restrainers on all end of branches and arm overs in excess of 12-inches.

3.5 INSTALLATION – VALVES

A. Install drain valves at main shut-off valves, low points of piping and apparatus.

B. All valves shall be accessible for operation and servicing. Provide access panels where required.

C. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

D. Install butterfly valves for shut-off or isolating service.

3.6 TESTING

A. Piping: The complete system shall be subject to a pressure test, and to such other tests as the authorities having jurisdiction may require. The pressure test shall be a hydrostatic pressure of 200 pounds per square inch for a period of two hours. The above ground piping and attached appurtenances shall show no pressure loss or leaks, refer to NFPA Standard 13 Hydrostatic tests. Before applying specified test pressure, all air must be expelled from the system. All defects of whatever type shall be repaired or replaced to the satisfaction of the Owner and authorities having jurisdiction and at no additional cost to the Owner. Packing rings, special joint bolts, gaskets, and other material required for the proper installation of the pipe and fittings shall be provided. Testing shall be completed prior to permanent sealing of walls and partitions.

B. Leaks in mechanical joints shall be repaired by dismantling the joint, reassembling it, and tightening the bolts in the correct order. Leaks in screw or grooved joint shall be repaired by dismantling the joint and reassembling it. Attempting to repair leaks in joints by over tightening the bolts or fittings shall not be permitted.

C. Upon satisfactory completion of all tests, the Contractor shall submit three copies of the Standard Contractors Material and Test Certificate to the Owner.

3.7 INTERFACE WITH OTHER PRODUCTS

A. Inserts:
1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Install hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.8 CLEANING

A. Division 01 - General Requirements.

B. Clean entire system after other construction is complete.

END OF SECTION

SECTION 210516 - EXPANSION FITTINGS AND LOOPS FOR FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor, Subcontractors, and/or suppliers providing goods and services referenced in or related to this Section shall also be bound by the Related Documents identified in Division 01 Section “Summary.”

1.2 SUMMARY

A. Section Includes:

1. Flexible pipe connectors.

2. Expansion joints.

3. Expansion compensators.

4. Pipe alignment guides.

5. Swivel joints.

6. Pipe anchors.

B. Related Sections:

1. 21 05 00 - Common Work Results for Fire Suppression: Product and installation requirements for piping used in fire protection systems.

2. Section 21 13 13 – Wet-Pipe Sprinkler System.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Services Piping.

2. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

1.4 DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints. Submit shop drawings sealed by a registered professional engineer.

C. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

D. Design Data: Indicate criteria and show calculations. Submit calculations sealed by a registered professional engineer.

E. Manufacturer's Installation Instructions: Submit special procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Welders' Certificate: Include welders' certification of compliance with ASME Section IX. AWS D1.1.

H. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

C. Operation and Maintenance Data: Submit adjustment instructions.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

B. Perform Work in accordance with the Connecticut State Building Code and Connecticut State Fire Safety Code.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

C. Design expansion compensating system under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Connecticut.

1.9 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.11 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish one year manufacturer warranty for leak free performance of packed expansion joints.

1.12 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Supply two 12 ounce containers of packing lubricant and cartridge style grease gun.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Manufacturers:

1. Mason.

2. Metraflex.

3. Vibration Eliminator.

4. Substitutions: Section 01 60 00 - Product Requirements.

5. Inner Hose: Carbon Steel.

6. Exterior Sleeve: Double braided stainless steel.

7. Pressure Rating: 125 psig WSP and 450 degrees F.

8. Joint: Flanged.

9. Size: Use pipe-sized units.

10. Maximum offset: 3/4 inch on each side of installed center line.

2.2 EXPANSION JOINTS

A. Manufacturers:

1. Metraflex.

2. Mason.

3. Vibration Elimination.

4. Substitutions: Section 01 60 00 - Product Requirements.

5. Pressure Rating: 200 psig WOG and 250 degrees F.

6. Maximum Compression: 1-3/4 inch.

7. Maximum Extension: 1/4 inch.

8. Joint: Flanged.

9. Size: Use pipe sized units

10. Application: Steel piping 3 inch and smaller.

2.3 ACCESSORIES

A. Manufacturers:

1. Metraflex.

2. Mason.

3. Vibration Elimination.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

C. Swivel Joints:Fabricated steel body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install Work in accordance with ASME B31.9.

B. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

C. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.

D. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 21 05 00 for pipe hanger installation requirements.

E. Provide grooved piping systems with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation. Grooved piping systems need not be anchored.

F. Provide expansion loops as required.

3.2 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Manufacturers’ field services.

B. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

SECTION 211119 - FIRE DEPARTMENT CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exposed-type fire-department connections.

2. Flush-type fire-department connections.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual componentsand profiles, and finishes for each fire-department connection.

1.3 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

PART 2 - PRODUCTS

2.1 YARD-TYPE FIRE-DEPARTMENT CONNECTION:

A. Type: Exposed, freestanding.

B. Pressure Rating: 300 psig.

C. Body Material: Corrosion-resistant metal.

D. Inlets: Brass with threads.

E. Extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

F. Caps: Brass, lugged type, with gasket and chain.

G. Escutcheon Plate: Round, brass, floor type.

H. Outlet: Bottom, with pipe threads.

I. Sleeve: Brass.

J. Sleeve Height: 18 inches.

K. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE."

L. Finish, Including Sleeve: Rough brass or bronze.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install exposed yard/free standing fire-department connections.

B. Install yard-type fire-department connections in concrete slab support. Comply with requirements for concrete in Section 033000 "Cast-in-Place Concrete."

C. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 211119

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wet-pipe sprinkler system, system design, installation, and certification.

B. Related Sections:
1. Section 21 05 00 - Common Work Results for Fire Suppression: Product and execution requirements for pipe, fittings, valves, hangers, supports, identification and painting for placement by this section.
2. Section 21 05 16 – Expansion Fittings and Loops for Fire-Suppression Equipment.
3. Section 22 04 00 – General Conditions for Fire Suppression Trades
4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.2 REFERENCES

A. National Fire Protection Association:
1. NFPA 13 - Installation of Sprinkler Systems.

B. Underwritters Laboratory:
1. UL - Fire Resistance Directory.

1.3 SYSTEM DESCRIPTION

A. Provide a wet pipe system hydraulically designed in accordance with NFPA 13 and all requirements of the local Authority Having Jurisdiction.

B. System to provide coverage for entire building.

C. Provide system to NFPA Standard occupancy requirements as noted on the drawings.

D. Provide updated flow test performed within the past 6 months.

E. Interface system with building fire alarm system.

F. The sprinkler locations and piping arrangements indicated on the contract documents are diagrammatic. It is the responsibility of the contractor to fully coordinate sprinkler and piping locations with all other trades.

G. Sprinkler locations indicated on the Contract Documents indicate sprinkler coverage utilizing standard coverage sprinklers maximum 225 square feet per sprinkler for light hazard and 130 square feet per sprinkler for ordinary hazard. Extended coverage sprinklers shall not be installed in any locations unless specifically indicated on the Contract Document drawings.

H. All sprinklers installed in a light hazard classification occupancy shall be a listed quick response type.

I. Provide fire department connections.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Where the terms “authorities having jurisdiction” is used, within this Specification, it is intended to include the Insurance Underwriter and all regulatory agencies having vested interest in this project.

C. Shop Drawings:
1. Provide fire protections shop drawings drawn to a minimum scale of ¼”=1’-0”. Indicate pipe materials used, joining methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
2. Provide hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories. Indicate system controls.
3. All sprinkler drawings and calculations shall bear the seal of a Professional Engineer licensed in the State of Florida. Seal and signature shall not be copied and shall be provided as an original drawing and each calculation.
4. Sprinklers shall be as shown on drawings and submittals and shall be specifically identified with the applicable style or series designation as published in the appropriate agency listing or approval. Trade names or other abbreviated designations are not permitted.

D. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

E. After successful review by the Engineer, submit sprinkler layout shop drawings, product data, and hydraulic calculations to authority having jurisdiction, Fire Marshall, and Owner's insurance underwriter for approval. Submit proof of approval to Architect/Engineer.

F. Grooved joint couplings and fittings shall be shown on shop drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series designation.

G. Manufacturer’s Certificate: Certify that system has been tested and meets or exceeds specified requirements and all code requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

A. Workmanship and Qualifications: All materials and equipment shall be installed in accordance with NFPA and all applicable local codes and ordinances. The Sprinkler Contractor shall be state licensed to install sprinkler systems. The Sprinkler Contractor shall make sure that all work and materials conform to the requirements set forth by this Specification. Fire protection equipment shall be installed to conform to NFPA as applicable, and devices used shall be listed and approved by Underwriters laboratories (UL) and/or Factory Mutual (FM).

B. Codes and Standards: All work shall be equal or superior to that required by codes, regulations, ordinances, and laws imposed by the jurisdictional authorities, including those of the State of Connecticut, State Fire Marshall, local ordinances and OSHA. Nothing in the Specifications permit violations of such directives, and where conflict occurs, the directive shall govern, except where superior work is specified or indicated.

C. In addition to complying with the above codes and regulations, comply with the requirements of the following:
   1. NFPA Standard 13.
   2. NFPA Standard 24.
   3. State Building and Fire Codes.
   4. Local Jurisdictional Authorities.

D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

E. Valves: Bear UL and/or FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

F. All items of similar class shall be the products of the same manufacturer. All valves, accessory items, etc., shall be from the same source.

G. Maintain one copy of each applicable NFPA standard on site.

H. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

I. Installer: Company specializing in performing work of this Section with minimum five years experience.

J. Design sprinkler system under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State of Florida.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver and store products in shipping containers, with labeling in place.

C. All equipment, valves, gages and etc., shall be covered and protected during the execution of the work. All equipment and piping shall be protected from freezing. Labeling to remain in place.

D. All unloading, hauling, and handling of materials shall be the responsibility of the Sprinkler Contractor.

E. The Sprinkler Contractor can obtain information on available storage space on site from the Owner when making examination of the site.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.10 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish extra sprinklers under provisions of NFPA 13.

C. Furnish suitable wrenches for each sprinkler type.

D. Provide metal storage cabinet adjacent to the sprinkler riser.

PART 2 PRODUCTS

2.1 SPRINKLERS

A. Manufacturers:
1. Viking.
2. Tyco.
3. Victaulic.
4. Grinnell Corp.
5. Reliable Sprinkler Corp.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. All sprinklers shall be adjustable, glass bulb, automatic sprinklers with ½ inch orifice and 5.6 K-factor unless noted otherwise. Type of sprinkler head shall be as indicated on the plans and in accordance with the following.

C. Sprinkler bodies shall be die-cast brass, with hex shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation.

D. Unless noted otherwise, ordinary temperature rated sprinkler heads shall be used throughout the building.

E. Where sprinklers will be installed in close proximity to heat sources and special locations, as identified in NFPA 13, temperature ratings shall be in accordance with the requirements of NFPA 13

F. Where plans call for extended coverage sprinkler heads coordinate coverage requirements with required pressure and K-factor.

G. Spare Sprinklers: The Sprinkler Contractor shall furnish spare automatic sprinklers in accordance with the requirements of NFPA for stock of extra sprinklers. The sprinklers shall be packed in a suitable container and shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. The Sprinkler Contractor shall furnish no less than two special sprinkler wrenches, or at least one wrench for each container or sprinkler box, whichever is greater.

H. In areas where sprinkler heads are subject to physical damage, provide sprinkler guard assembly over head, finish to match sprinkler finish. This shall include but not limited to the following locations.
1. Heads in elevator shafts.
2. Heads under lower rakes of stairways.
3. Heads in electrical rooms, boiler rooms and other mechanical rooms.
4. Heads installed 7'-0" or less above finished floors.
5. Heads in gymnasium areas.

2.2 BURIED PIPING

A. Ductile Iron Pipe: ANSI/AWWA C151, cement lined.
1. Fittings: ANSI/AWWA C110, standard thickness.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
3. Joints: ANSI/AWWA C111, rubber gasket.

B. HDPE Pipe: FM 1613, ANSI/AWWA C906, ASTM F714, ASTM D3350 Cell Class 445574C/E, PPI (TR-4) PE 4710, ANSI/NSF 61/14

2.3 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53; Schedule 40 seamless carbon steel. Schedule 10 pipe shall be allowed for pipe sizes larger than 2" diameter when roll grooved mechanical couplings are used. [Welded outlet fittings or other "hole cut" type fittings shall not be used.] [Plain end joint connections shall not be used.]
1. Cast Iron Fittings: ANSI/ASME B16.1, flanges and flanged fittings; ANSI/ASME B16.4, screwed fittings.
2. Malleable Iron Fittings: ANSI/ASME B16.3, screwed Class 300 type. Threads shall conform to ANSI/ASTM A47.
3. Grooved Mechanical Fittings: ANSI A21.10/AWWA C-110 ductile iron; ASTM A536 Grade 65-45-12 ductile iron; ASTM A234 Grade WPB; or factory fabricated from carbon steel pipe conforming to ASTM A53; with grooves or shoulders designed to accept grooved end couplings. Fittings shall be of the same manufacturer as the adjoining couplings. Grooved Mechanical Couplings: ASTM A536 Grade 65-45-12, ductile iron housing, elastomer gasket with nuts and bolts to secure roll grooved pipe and fittings.

Fire Protection Service	**Temperature Range**	**Gasket Recommendation**
Freezer Applications	-40°F to 0°F	FlushSeal®, Grade L, Silicone
Water/Wet Systems	Ambient	C-Shape or EZ Style 009

a. Rigid Type Couplings: Housings cast with offsetting, angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with NFPA-13.

1) 1-1/4” through 4”: Factory assembled for direct stab installation without field disassembly. Victaulic Style 009 EZ.
2) 5” through 8”: Victaulic FireLock™ Style 005.
3) 10” and larger: Victaulic Zero-Flex® Style 07.

b. Flexible Type Couplings: Use in locations where vibration attenuation and stress relief are required, and for seismic considerations in accordance with the manufacturer’s instructions. Victaulic Style 75.

B. CPVC Pipe: ASTM F442/F442M, SDR 13.5.
1. Fittings: ASTM F438 schedule 40, or ASTM F439 schedule 80, CPVC.
2. Joints: ASTM F493, solvent weld.

2.4 UNIONS AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches (50 mm) and Under:
1. Ferrous Piping: 150 psig (1034 kPa) malleable iron, threaded.

B. Dielectric Connections: Union, waterway fitting, or flange with water impervious isolation barrier; Victaulic Style 47 or Watts 3000 Series or approved equal.

2.5 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 13

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: [Malleable iron] [Carbon steel], adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp [Angle ring].

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.6

2.7 ALARM CHECK VALVES

A. Manufacturers:
1. Viking.
2. Tyco.
3. Victaulic.
4. Grinnell Corp.
5. Reliable Sprinkler Corp.

6. Approved Equal

B. Wet Pipe Alarm Valve:
1. Check type valve with Nitrile seat o-ring aluminum bronze clapper with EPDM seal to automatically actuate electrically and hydraulically operated alarms, with pressure retard chamber and variable pressure trim. Valve internal components shall be replaceable without removing valve from the installed position. Valve shall be Series 751 as manufactured by Victaulic Co or engineer approved equal.
2. Provide retard chamber as part of wet alarm valve trim to allow for pressure fluctuations. Retard chamber shall be Victaulic Series 752 or engineer approved equal by manufacturers listed above. Provide all other trim as recommended by the manufacturer.
3. Alarm check valve assembly shall allow discharge of one or more sprinklers to activate electric and hydraulic alarms.

2.8 SPRAY HEADS

A. Manufacturers:
1. Viking
2. Tyco
3. Grinnell Corp.
4. Reliable Sprinkler Corp.
5. Substitutions: [Section 01 60 00 - Product Requirements] [Not Permitted].

B. Furnish materials in accordance with NFPA standards.

2.9 PIPING SPECIALTIES

A. Manufacturers:
1. Potter.
2. Potter-Roemer.
3. System Sensor.
4. Victaulic.
5. Viking.
6. Approved Equal

B. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two form C contacts; rated 10 amp at 120 volt.

C. Valve Tamper Supervisory Switch: Two form C contacts; rated 10 amp at 120 volt. UL listed and FM approved. Up to 2” – Potter Model PCVS-1. Over 2" switch shall be Potter Model OSYSU-2.

D. Pressure Switch: ½ inch male pressure connection to alarm valve riser and actuated by any flow of water in excess of one sprinkler. Maximum pressure rating 175 psi, weather-proof with tamper resistant screws, rated 10 amps at 120 volt.

E. Pressure Gage: Rated for 300 psi use, 3-1/2” in diameter.

2.10 FIRE DEPARTMENT CONNECTION

A. Fire department connection shall be 2-1/2”x2-1/2”x4”, polished brass, single clapper, flush mounted, siamese connection. Provide with polished brass identification plate.

B. Clapper design shall allow for one or both inlets to be pressurized during operation.

C. Provide polished brass cast aluminum alloy caps and chains for protection of the 2-1/2” inlets.

D. The fire department connection shall be constructed of cast brass with brass clapper, brass swivel couplings and a brass hinge pin. The words “AUTO SPKR” and “F.D. Conn” shall be cast in raised letters on the body.

E. Fire department connection threads shall match the local fire departments standard.

F. Drain: 3/4 inch automatic drip, install at low point after check valve, pipe to building exterior.

G. Label: "Standpipe - Fire Department Connection"..

H. Roof Hydrant Connection:
1. Type: Freestanding type with ductile iron pedestal and brass finish.
2. Outlets: Two-way with thread size to suit Fire Department hardware; threaded dust cap and drain of matching material and finish
3. Drain: 3/4 inch automatic ball drip to drain
4. Label: "Standpipe - Fire Department Connection".
5. Roof hydrant connection shall be Crocker.
6. Provide with roof hydrant control valve, thru the wall type. Provide with indicator plate to determine position of gate valve located below roof. Valve shall be UL listed and FM approved.

I. Provide a 90-degree elbow with drain connection at each fire department connection to allow for drainage in areas exposed to the building exterior to prevent freezing. Elbow shall be Victaulic #10-DR.

PART 3 EXECUTION

3.1 PREPERATION

A. Coordinate work of this Section with other affected work.

B. Prepare piping connections to equipment with grooved joint couplings, flanges, or unions.

3.2 INSTALLATION

A. Install equipment in accordance with manufacturers instructions.

B. Install fire protection systems in accordance with [NFPA 13 for sprinkler systems], [NFPA 13D for sprinkler systems], [NFPA 13R for sprinkler systems], [and] [NFPA 24 for service mains].

C. Impairments to the existing water supplies shall be minimized. All work shall be complete before making the final connections to the existing water supplies. The Contractor shall notify the owners representative before impairing any fire protection equipment.

D. The Contractor shall maintain a clean and orderly site during the installation of the sprinkler system. Materials shall not be stored in the halls or other public areas.

E. Cutting, welding and other hot work shall not be permitted without permission from the building owner. Contractor shall provide a fire watch for one hour after all welding

F. The required tests shall be witnessed by the Fire Marshall, authority having jurisdiction, Owner's insurance underwriter and Architect/Engineer.

G. Locate fire department connection with sufficient clearance from walls, obstructions, etc., to allow full swing of fire department wrench handle. Coordinate the exact location of the fire department connection with the local fire officials. Installation shall conform to the local fire officials requirements.

H. Installation of Alarm Valves: Install a drain line from the drain connection to the [nearest floor drain]. Install a test line from the test connection to [the exterior of the building. Provide a splash block.] Provide gate valves at each line. [Minimum alarm valve riser shall be 4-inch.]

I. Locate outside alarm gong on building wall

J. Center heads in [two directions in ceiling tile and provide piping offsets as required.] [one direction only in ceiling tile with location in other direction variable, dependent upon spacing and coordination with ceiling elements].

K. Sprinkler Bulb protector must remain in place until the sprinkler is completely installed. Remove the bulb protector by hand after installation and before the system is placed in service. (Do not use any tools to remove the bulb protector.)

L. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

M. Coordinate flow switches, tamper switches, and all other sprinkler devices with the fire alarm system.

N. Provide wire guards on sprinklers as indicated on drawings.

O. Place pipe runs to minimize obstruction to other work.

P. Install piping in concealed spaces above finished ceilings.

Q. Pipe and fitting shall be installed per the manufacture’s installation requirements. The fire protection contractor shall furnish all materials necessary to meet these requirements including but not limited to hangers, support, insulation, shields, sleeves and power supplies.

R. Hydrostatically test entire system in accordance with the requirmetns of NFPA 13 (?).

S. Install air compressor on vibration isolators. Pipe receiver tank drain to nearest floor drain.

T. Require test be witnessed by [Fire Marshall.] [Authority having jurisdiction.] [Owner's insurance underwriter.] [Architect/Engineer.]

3.3 INTERFACE WITH OTHER PRODUCTS

A. Verify signal devices are installed and connected to fire alarm system.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements:Final cleaning.

B. Flush entire piping system of foreign matter.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. [Replace painted sprinklers with new.]

3.6 IDENTIFICATION

A. Provide and apply signs to control, drain, test and alarm valves to identify their purpose and function.

B. Provide and permanently attach hydraulic calculations data nameplate at the controlling valve for the sprinkler system. Provide lettering size and style from NFPA's suggested styles.

3.7 TESTING

A. Section 21 05 00 - Common Work Results for Fire Suppression.

END OF SECTION

SECTION 220400 - GENERAL CONDITIONS FOR PLUMBING TRADES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

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

B. This section applies to certain sections of Division 26, "Electrical," and this section applies to all sections of Division 22, "Plumbing" of this project specification unless specified otherwise in the individual sections.

C. The Drawings of other trades (Architectural, Food Service, Structural, Landscape, Civil, Mechanical, Fire Protection and Electrical) shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

1.2 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division. Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

1.3 INTENT

A. It is the intent of the Specifications and Drawings to call for finished work, tested and ready for operation. Provide all parts necessary for the intended use, fully complete and operational, and installed in professional manner in accordance with the design intent.

B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and ready for operation as determined by good trade practice even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.

C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary

items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section includes the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

1.4 DEFINITIONS

A. “Approved equal” also known as “alternative” mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.

B. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

D. “Finished” refers to all rooms and areas to be specified to receive architectural treatment as indicated on the drawings. All rooms and areas not covered, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

E. “Furnish” or “supply” shall mean purchase, deliver to, and off-load at the job site, ready to be installed including where appropriate all necessary interim storage and protection.

F. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

G. “Install” shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.

H. "Lead Free" shall mean not more than .25% in the wetted surface area.

I. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

J. “Product” shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

K. “Provide” shall mean furnish (or supply) and install as necessary.

L. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

M. Remove: The term “remove” means “to disconnect from its present position, remove from the premises and to dispose of in a legal manner.”

N. Special Warranties: The term “Special Warranties” are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

O. Standard Product Warranties: The term “Standard Product Warranties” are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

P. “Subcontractor” means specifically the subcontractor working under this Division. Other Contractors are specifically designated “Plumbing Subcontractor”, “General Contractor” and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.

Q. Substitutions: Requests for changes in products, materials, equipment, and methods of construction proposed by the Contractor are considered requests for "substitutions."

R. “Wiring” shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

1.5 CONTRACT DOCUMENTS

A. The two dimensional drawings govern the construction. They show the design intent and are part of the Contract Documents. BIM models are not part of contract documents. They are developed for convenience only.

B. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)

C. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.

D. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

1.6 DISCREPANCIES IN DOCUMENTS

A. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.

B. Where Drawings or Specifications conflict or are unclear, submit clarification request in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or un-clarities thus resolved.

C. Where Drawings or Specifications do not coincide with manufacturers' recommendations or with applicable codes and standards, submit clarification request in form of an RFI before installation. Otherwise, make changes in installed work required for compliance with manufacturer instructions or codes and standards within Contract Price.

D. Where insufficient information exists in the documents to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building elements, where notification required by Paragraph (B) above has not been submitted, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in professional manner either concealed or exposed in accordance with the design intent.

E. Where discrepancies exist between the mechanical, plumbing, fire protection, and electrical drawings in regards to what trade owns disconnects or starters, the discrepancy shall be brought to the Architect's attention in accordance with paragraph (B) above. If the scope is not resolved prior to the Award of Contract, Division 26 shall provide such items.

1.7 SURVEYS AND MEASUREMENTS

A. Before submitting the Bid, the Contractors shall visit the site and become thoroughly familiar with all existing conditions under which work will be installed. This Contract includes all modifications of existing systems required for the installation of new equipment. This Contract includes all necessary offsets, transitions and modifications required to install all new equipment in existing spaces. All new and existing equipment and systems shall be fully operational under this Contract before the job is considered complete. The Contractors shall be held responsible for any assumptions made, any omissions or errors made as a result of their failure to become fully familiar with the existing conditions at the site and the Contract Documents.

B. 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 the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or which interfere with the intent of the Drawings and Specifications, the Engineer will be notified and work will not proceed until instructions from the Engineer are received.

1.8 CODES AND STANDARDS

A. Reference Standard Compliance

1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

2. Independent Testing Organization Certificate: In lieu of the label or listing indicated above, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. Wherever Codes and/ or standards are mentioned in these specifications, the latest applicable edition or revision of the local building or life safety code shall be followed.

C. The following Standards shall be used where referenced by the following abbreviations:

ACGIH	American Conference of Governmental Industrial Hygienists
AGA	American Gas Association
AIA	American Institute of Architects
ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society of Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CGA	Compressed Gas Association
CSA	Canadian Standards Association
CISPI	Cast Iron Soil Pipe Institute
EJMA	Expansion Joint Manufacturing Association
EPA	Environmental Protection Agency
FM	Factory Mutual
FSSC	Federal Specification
HIS	Hydraulic Institute Standards

IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
ISO	Insurance Services Office
MCAA	Mechanical Contractors Association of America
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NOFI	National Oil Fuel Institute
NSC	National Safety Council
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PDI	Plumbing and Drainage Institute
SBI	Steel Boiler Industry (Division of Hydronics Institute)
SDWA	Safe Drinking Water Act
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
STI	Steel Tank Institute
UL	Underwriters' Laboratories

D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.9 PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the work, file all necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for

his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.10 EQUIPMENT EQUIVALENTS AND SUBSTITUTIONS

A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of quality, finish and design that is required. If the Contractors uses an "approved equal" alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.

B. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.

C. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.

D. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non-approved equivalent to that specified and the amount of credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer's equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

E. If an alternative or substitute item results in a difference in quantity and arrangement of structure, piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.

F. Equipment, material or devices submitted for review as a "substitution" shall meet the following requirements:

1. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.

2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

   a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.

   b. Samples, where applicable or requested.

   c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.

   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

   f. Cost information, including a proposal of the net change, if any in the Contract Sum.

   g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

   h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.

   i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

      1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.

2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.11 SUBMITTAL PROCEDURES

A. Provide Submittals in accordance with the requirements of Division 01 and as indicated in the following.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

1. Allow ten business days for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.

2. If an intermediate submittal is necessary, process the same as the initial submittal.

3. Allow ten business days for reprocessing each submittal.

4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block. Submittals shall be arranged in order of specification sections.

1. Include the following information on the label for processing and recording action taken.

a. Project name.

b. Date.

c. Name and address of Engineer.

d. Name and address of Contractor.

e. Name and address of subcontractor.

f. Name and address of supplier.

g. Name of manufacturer.

h. Number, title and paragraph of appropriate Specification Section.

i. Drawing number and detail references, as appropriate.

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

F. Except for submittals for record, information or similar purposes, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.

G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.

1.12 SHOP DRAWINGS

A. Submit neatly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated plumbing layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly

reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review all shop drawings to be incorporated in the Plumbing Contract.

C. Provide shop drawings for all devices specified under equipment specifications for all systems. Shop drawings shall include manufacturers' names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures), of all shop drawings, performance cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.

D. When a submittal could involve more than one trade, e.g., valves, piping, etc., the submitted shall be separated by traded involved, ie. HVAC, plumbing, fire protection, etc.

E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.

F. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

G. "No Exception Taken" rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings. Review of shop drawings shall not apply to quantity of material.

H. After shop drawings have been reviewed, with no exceptions taken, no further changes will be allowed without the written consent of the Engineer.

I. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

J. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to bidding to allow for issuance of an Addendum.

K. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

L. All submittals shall be made in electronic PDF format with searchable OCR (Optical Character Recognition) format. This excludes scanned and faxed materials.

1.13 COORDINATION DRAWINGS AND BIM MODEL

A. Coordination drawings are required for all fire protection, plumbing, mechanical and electrical trades. The content and procedures described in Division 01 shall be followed, with the additional requirements specifically for the plumbing and electrical trades as described in this Section. If a BIM model is not used on this project, the below requirements shall be accomplished in CAD.

B. Prepare coordination drawings in accordance with Division 01 to a minimum scale of 1/4"=1'-0" 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. The Contractor shall indicate the proposed locations of piping, conduit, ductwork, equipment, and materials. Include the following:

a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

b. Equipment connections and support details.

c. Exterior wall and foundation penetrations.

d. Fire-rated wall and floor penetrations.

e. Sizes and locations of required concrete pads and bases.

C. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

D. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

E. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

F. The Contractor and each subcontractor shall sign and date each coordination drawing prior to submission.

G. Work shall not be performed until coordination drawings have been approved by the architect and engineer.

H. Electronic copies of the MEP floor plans and/or BIM model are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. If the Contractor elects to obtain the Engineers electronic files an Electronic Drawing File Release Form must be submitted. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic Drawing File Release Form, the Engineer will provide copies of the electronic files for the Contractor's use. A

copy of the Electronic Drawing File Release Form is appended to the end of this specification section

I. Review by Engineer of coordination drawings is limited to confirming that requirements for coordination and preparation of plans have been complied with by the Contractor and shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other related work.

1.14 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, HVAC piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

E. The two dimensional drawings are diagrammatic. They indicate general arrangements of mechanical systems and other work, and are intended to convey sufficient information for skilled contractors and tradespeople to furnish and install complete systems. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, provide all other components and materials to make the systems fully complete, coordinated with other systems and the structure and space available, and operational. Similarly, the drawings do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades in order to avoid interferences and to meet ceiling heights and other Architectural requirements. Establish and provide offsets, changes in direction, and exact routings to coordinate all systems. Where conflicts or potential conflicts exist and engineering guidance is desired, submit a “Request for Information” (RFI).

F. Controls contractor shall coordinate and sequences of operation with all other trades as necessary to provide a complete and functioning system.

1.15 QUALITY CONTROL

A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled tradespeople, fitters, metal workers, welders, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

E. All labor for installation of plumbing systems shall be performed by experienced, skilled tradespeople under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, professional manner. The Engineer reserves the right to reject any work which, in their opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.16 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner.

B. The Engineer and the Owner shall be notified in writing of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.17 TEMPORARY UTILITIES

A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

C. First Aid Supplies: Comply with governing regulations.

D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

E. Utilities: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.

1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.

F. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

G. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

H. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.18 EQUIPMENT ACCESS

A. Appliances, controls devices, valves and accessories that utilize energy shall be accessible for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, venting systems or any other piping not connected to the appliance being inspected, serviced, repaired or replaced. A level working space not less than 30 inches deep and 30 inches wide shall be provided in front of the control side to service an appliance.

1.19 PROJECT PHASING

A. Work under each Section shall include all necessary temporary connections, equipment, piping, heating, temperature control work, fire stopping, water heaters, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required

to maintain existing systems operational or to accommodate the construction phasing of the project.

1.20 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or tradespeople and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by tradespeople or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.21 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer’s recommendations and is operating as intended by the manufacturer.

1.22 CLEANING

A. The Contractor shall thoroughly clean and flush all piping and equipment of all foreign substances, oils, burrs, solder, flux, etc., inside and out before being placed in operation.

B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. During the course of construction, all pipes shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work. Any oil or grease stains on floor areas caused by the Contractor shall be removed and floor areas left clean.

E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Remove labels that are not permanent labels.

2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

4. Wipe surfaces of plumbing equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition.

F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material, skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.

G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

1.23 OPERATING AND MAINTENANCE

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall fully instruct the Owner or the Owner’s representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) days’ notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.

C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

D. An authorized manufacturer's representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. The following equipment will require this inspection: pumps; controls, water heaters, compressors, boilers etc. These letters shall be bound into the operating and maintenance books.

E. Refer to individual trade Sections for any other particular requirements related to operating instructions.

F. Demonstration shall be recorded on USB Flash drive and turned over to the Owner. Video recording shall be done in a professional manner with quality video (1080p resolution) and clear audible sound.

1.24 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with the requirements of Division 01 and as follows. The Contractor shall prepare up to six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-ring vinyl-covered binders, with pocket folders for folded sheet information and designation partitions with identification tabs. Mark appropriate identification on front and spine of each binder.

B. Manual shall include the following:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing and operating instructions including lubrication charts and schedules.

5. Emergency and safety instructions.

6. Spare parts list.

7. Copies of warranties.

8. Wiring diagrams.

9. Recommended "turn around" cycles.

10. Inspection procedures.

11. Approved Shop Drawings and Product Data.

12. Equipment Start-up Reports.

13. Balance reports.

C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, bearing number, etc. Schedule shall include maintenance to be done and frequency.

D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.

1.25 ACCEPTANCES

A. The equipment, materials, quality, design and arrangement of all work installed under the Plumbing Sections shall be subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, the Plumbing Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Plumbing Sections. The intent to use the exact manufacturers and models specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of award of the Contract. In such instances, equipment substitutions may be made pending acceptance by the Engineer or the Owner’s representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Plumbing Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.26 RECORD DRAWINGS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Items to be indicated include but are not limited to:

1. Dimensional change
2. Revision to drawing detail
3. Location and depth of underground utility
4. Revision to pipe routing
5. Revision to electrical circuitry
6. Actual equipment location
7. Pipe size and routing
8. Location of concealed internal utility
9. Changes made by Change Order
10. Details not on original Contract Drawing
11. Information on concealed elements which would be difficult to identify or measure later

C. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

D. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

E. Note related Change Order numbers where applicable.

F. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

G. Final record documents shall be prepared in the latest electronic version and on USB Flash drive of all drawings and a clean set of reproducible paper copies shall be turned over to the Owner at the completion of the work.

1.27 WARRANTIES AND BONDS

A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers' standard warranties on products and special warranties are to be included:

1. General close-out requirements included in Division 01.

2. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions-02 through -50.

3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.28 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.

1. Refer to individual Sections of Divisions-02 through -50 for specific content requirements, and particular requirements for submittal of special warranties.

J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.

3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.29 GUARANTEES

A. The Contractor shall guarantee all material and installation quality under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner. During this guarantee period, all defects developing through faulty equipment, materials or installation quality shall be corrected or replaced immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineer's satisfaction.

B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided.

1.30 PROJECT CLOSE-OUT

A. Submit specific warranties, quality bonds, maintenance agreements, final certifications and similar documents in accordance with Division 01.

B. Deliver tools, spare parts, extra stock, and similar items.

C. Complete start-up testing of systems, including measuring and documenting all required startup checklist requirements documented in installation and maintenance instructions by the equipment manufacturer, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

D. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

E. Field Observation Procedures: On receipt of a request for an Engineers Field Observation, the Engineer will advise the Contractor of unfulfilled requirements. The Engineer will advise the Contractor of construction that must be completed or corrected before the certificate will be issued. Contractor shall submit written response to each corrective item including specific photos prior to final Engineering inspection.

1. The Engineer will repeat the Field Observation when requested and assured that the Work has been substantially completed.

2. Results of the completed list of unfulfilled items will form the basis of requirements for final acceptance.

END OF SECTION

Electronic Drawing File Release Form

DELIVERY OF ELECTRONIC FILES FOR: _____
Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Contractor covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Contractor further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Contractor agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Contractor agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys' fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____ _____
Contractor's Signature Date

_____
Company - Title

_____ _____
Architects' Signature Date

_____
Firm - Title

_____ _____
Owner's Signature Date

_____
Company - Title

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. Identification for Piping and Equipment

1. Nameplates.

2. Tags.

3. Pipe markers.

4. Ceiling tacks.

5. Labels.

6. Radon Labels

1.2 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. American Society of Mechanical Engineers:

1. ASME B31.1 - Power Piping.

2. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84-18b - Standard Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction Materials.

3. ASTM E814-13a - Standard Test Method for Fire Tests of Penetration Fire Stop Systems.

4. ASTM F708-92 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

5. ASTM E1966-15 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Underwriters Laboratories Inc.:

1. UL 263 - Standard for Fire Test of Building Construction and Materials

2. UL 723 – Standard for Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 – Standard for Fire Tests of Penetration Firestops.

4. UL 2079 – Standard Tests for Fire Resistance of Building Joint Systems.

5. UL - Fire Resistance Directory.

1.3 SUBMITTALS

A. See Division 01 – Requirements for Submittals.

B. Shop Drawings: Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Shop Drawings (Identification): Submit list of wording, symbols, letter size, and color coding for identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Submit special procedures.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Welders’ Certificate: Include welders’ certification of compliance with ASME Section IX or AWS D1.1.

G. Manufacturer’s Field Reports: Indicate results of inspection by manufacturer’s representative.

H. Product Data:

1. Product Data for Pipe and Equipment Identification: Submit for mechanical identification manufacturers catalog literature for each product required.

I. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing work of this section with minimum three years of experience.

1.6 PRE-INSTALLATION MEETINGS

A. See Division 01 - General Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 - General Requirements.

B. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

C. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

1.8 WARRANTY

A. See Division 01 - General Requirements.

1.9 CLOSEOUT SUBMITTALS

A. See Division 01 - General Requirements.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, guides, tagged valves; include valve tag numbers.

C. Operation and Maintenance Data (Expansion): Submit adjustment instructions.

PART 2 PRODUCTS

2.1 CONCRETE HOUSEKEEPING PAD

A. Refer to Division 03 - Concrete

2.2 IDENTIFICATION FOR PIPING AND EQUIPMENT

A. Manufacturers:

1. Craftmark Identification Systems

2. Safety Sign Co.

3. Seton Identification Products

4. Substitutions: Division 01 – General Requirements and 22 04 00 – General Requirements.

B. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light background color.

C. Plastic Tags: Laminated three-layer plastic with engraved black letters on light background color, minimum 1-1/2 inches diameter.

D. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Color and Lettering: Conform to ASME A13.1.

E. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Color and Lettering: Conform to ASME A13.1.

F. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.3 NAMEPLATES

A. Manufacturers:

1. Craftmark Identification Systems

2. Safety Sign Co.

3. Seton Identification Products

4. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Product Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.

2. Letter Height: 1/4 inch

3. Background Color: Black.

4. Plastic: Conform to ASTM D709.

2.4 TAGS

A. Plastic Tags:

1. Manufacturers:

a. Craftmark Identification Systems

b. Safety Sign Co.

c. Seton Identification Products

d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:

1. Manufacturers:

a. Craftmark Identification Systems

b. Safety Sign Co.

c. Seton Identification Products

d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Aluminum with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:

1. Manufacturers:

a. Craftmark Identification Systems

b. Safety Sign Co.

c. Seton Identification Products

d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.5 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers:

   a. Craftmark Identification Systems

   b. Safety Sign Co.

   c. Seton Identification Products

   d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers:

1. Manufacturers:

   a. Craftmark Identification Systems

   b. Safety Sign Co.

   c. Seton Identification Products

   d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Plastic Underground Pipe Markers:

1. Manufacturers:

   a. Seton

   b. Northtown

   c. Kolbi

   d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with color code as follows:

a. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.

b. Fire Quenching Fluids: Red with white letters.

c. Toxic and Corrosive Fluids: Orange with black letters.

d. Flammable Fluids: Yellow with black letters.

e. Combustible Fluids: Brown with white letters.

f. Compressed Air: Blue with white letters.

g. Heat traced piping: to match the color code of the fluid or gas being used.

2.6 CEILING TACKS

A. Manufacturers:

1. Seton
2. Northtown
3. Kolbi
4. Substitutions: Division 01 - Product Requirements and 22 04 00 – General Requirements.

B. Description: Steel with 3/4 inch diameter color-coded head.

C. Color code as follows:

1. Plumbing valves: Green.

2.7 LABELS

A. Manufacturers:

1. Seton
2. Northtown
3. Kolbi
4. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Description: Polyester for above grade and Laminated Mylar for below grade, size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned motors

B. Maintain access to existing motors and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing motors to remain or are to be reinstalled.

3.2 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

A. Install plastic nameplates with adhesive.

B. Install plastic tags with corrosion resistant metal chain.

3.3 INSTALLATION - IDENTIFICATION

A. Install identification of heat traced pipe every 20 feet at minimum.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify valves in main and branch piping with tags.

J. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 10 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

K. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.4 FIELD QUALITY CONTROL

A. Division 01 - General Requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.15.

3.5 PROTECTION OF FINISHED WORK

A. Division 01 - General Requirements.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 220516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Design of expansion system and anchors
2. Flexible pipe connectors.
3. Expansion joints.
4. Expansion compensators.
5. Pipe alignment guides.
6. Swivel joints.
7. Pipe anchors.

B. Related Sections:
1. Section 22 04 00 – General Conditions for Plumbing Trades
2. Section 22 05 00 – Common Work Results for Plumbing: Product and installation requirements for piping hangers and supports.
3. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Product and installation requirements for vibration isolators used in piping systems.
4. Section 22 10 05 – Plumbing Piping: Product and installation requirements for piping used in domestic water systems.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.9 - Building Services Piping.
2. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

1.3 DESIGN REQUIREMENTS

A. Provide design, details, work and equipment required for expansion and contraction of hot water and hot water return piping systems. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

C. Expansion Compensation Design Criteria:
1. Installation Temperature: 70 degrees F.
2. Domestic Hot Water: 120-140 degrees F, refer to plans.
3. Domestic Hot Water Recirculation: 120-140 degrees F, refer to plans.
4. Safety Factor: 30 percent.

1.4 SUBMITTALS

A. See Division 01 – General Requirements: Requirements for submittals.

B. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints.

C. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
   2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

D. Manufacturer's Installation Instructions: Submit special procedures.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Welders' Certificate: Include welders' certification of compliance with ASME Section IX or AWS D1.1 as applicable

G. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.

1.5 CLOSEOUT SUBMITTALS

A. See Division 01 – General Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

C. Operation and Maintenance Data: Submit adjustment instructions.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

B. All pre-manufactured expansion fittings and loops installed on the domestic water system shall meet the requirements of SDWA 1417.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing work of this section with minimum three years of experience.

C. Design expansion compensating system under direct supervision of professional engineer experienced in design of this work and licensed at project location.

1.8 PRE-INSTALLATION MEETINGS

A. See Division 01 – General Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements: Product storage and handling requirements.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY

A. See Division 01 – General Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

A. See Division 01 – General Requirements: Spare parts and maintenance products.

B. Supply two 12 ounce containers of packing lubricant and cartridge style grease gun.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - STEEL

A. Manufacturers:
1. Metraflex Company – SLPC
2. Mason Industries Inc. / Mercer Rubber Company; - FFLSS Series
3. Flexicraft FF Series
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Inner Hose: 304 Stainless Steel

C. Exterior Sleeve: Single braided, type 304 stainless steel

D. Pressure Rating: 125 psi minimum working pressure at 70 degrees F.

E. Fittings Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. Copper fittings shall not be attached to stainless steel hose.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

2.2 FLEXIBLE PIPE CONNECTORS - COPPER

A. Manufacturers:
1. Metraflex Company Series BBSC
2. Mason Industries Inc. Series CPSB
3. Flexicraft Series SS
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi minimum working pressure at 70 degrees F.

E. Fittings Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. Copper fittings shall not be attached to stainless steel hose.

F. Maximum offset: 1/2 inch on each side of installed center line.

G. NSF 61 and NSF 372 certified for use with potable water

2.3 EXPANSION JOINTS - STEEL WITH PACKED SLIDING SLEEVE (AXIAL MOVEMENT)

A. Manufacturers:
1. Hyspan Precision Products – Series 8500
2. Mason Industries / Mercer Rubber Company Type ECGWN
3. ATS (Advanced Thermal Systems, Inc.) - Thermal Pak Series
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Working Pressure and Temperature: Class 150.

C. Joint: Sweat or equivalent connection as specified for pipe joints.

D. Size: Use pipe sized units.

E. Application: Steel piping 2 inches and over.

2.4 EXPANSION JOINTS - COPPER WITH PACKED SLIDING SLEEVE (AXIAL MOVEMENT)

A. Manufacturers:
1. Hyspan Precision Products – Series 8500
2. Mason Industries / Mercer Rubber Company Type ECGWN
3. Flexicraft Compensator Series
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Working Pressure: 125 psi.

C. Maximum Temperature: 250 degrees F.

D. Joint: Flanged.

E. Size: Use pipe sized units.

F. Application: Copper or steel piping 2 inches and over.

2.5 EXPANSION LOOPS - HOSE AND BRAID

A. Manufacturers:
1. Metraflex Company: Metraloop
2. Mason Industries / Mercer Rubber Company: FFL Series or CPSB Series
3. Flexicraft: SS Connector Series
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support bracket and air release or drain plug.

C. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.

D. Flexible Connectors: Flanged or as specified in 22 0503 Pipe and Tubes for Plumbing and Equipment, braided type with wetted components of stainless steel, sized to match piping.
1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
2. Accommodate the Following:
   a. Axial Deflection in Compression and Expansion: To be determined by the Professional Engineer providing calculations.
   b. Lateral Movement: To be determined by the Professional Engineer providing calculations.
   c. Angular Rotation: 15 degrees.
   d. Force developed by 1.5 times specified maximum allowable operating pressure.
3. End Connections: Same as specified for pipe jointing.
4. Provide necessary accessories including, but not limited to, swivel joints.

2.6 EXPANSION JOINTS - EXTERNALLY PRESSURIZED EXPANSION JOINTS

A. Manufacturers:
1. Metraflex Company: Metragator
2. Mason Industries / Mercer Rubber Company: HEJFFL Series
3. Flexicraft: EP Series
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Construction: Stainless steel with anti-torque device, limit stops, internal guides.

C. Maximum Allowable Working Pressure: 150 psig at 700 degrees F.

D. Maximum Axial Compression: 4 inches.

E. End Connections: Flanged or weld end.

F. Size: Use pipe sized units.

G. Application: Steel piping 2 inches and over.

2.7 EXPANSION ACCESSORIES

A. Manufacturers:
1. Metraflex
2. Mason Industries / Mercer Rubber Company
3. Vibration Eliminator
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for insulation, minimum 3 inch travel.

C. Swivel Joints: Bronze, double ball bearing race, field lubricated, with Buna-N o-ring seals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install Work in accordance with ASME B31.9

C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Refer to Section 22 05 48. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.

F. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 22 05 00 for pipe hanger installation requirements.

G. Provide grooved piping systems with minimum three flexible couplings per flexible connector supported by vibration isolation.

H. Provide expansion loops as indicated on Drawings.

3.2 MANUFACTURER'S FIELD SERVICES

A. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

PIPING SYSTEM	PIPING MATERIAL	PIPE SIZE	CONDITION REQUIRING EXPANSION JOINT OR EXPANSION LOOP (ALL CONDITIONS ASSUME “OFFSET LEG” AT END OF RUNS ARE MINIMUM 12’0” LONG)
Domestic hot water supply and recirculation piping (all temperatures)	Copper	Up to 3 inches	All straight sections of piping over 90’ long. All straight sections of piping where “offset leg” is less than 12’0”
Domestic hot water supply and recirculation piping (all temperatures)	Steel	Up to 2 inches	All straight sections of piping over 140’ long.
Domestic hot water supply and recirculation piping (all temperatures)	Steel	2” to 4”	All straight sections of piping over 90’ long

END OF SECTION

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Gate valves.
2. Ball valves.
3. Butterfly valves.
4. Check valves.
5. Globe.
6. Pressure reducing.
7. Pressure relief.
8. Strainers.
9. Flow control devices.
10. Balancing valves.
11. Thermostatic mixing valves
12. Plug valves.
13. Gas solenoid valves.
14. Gas pressure regulators.

B. Related Sections:
1. Division 01 – General Requirements.

2. Section 220400 – General Conditions for Plumbing Trades
3. Section 220500 – Common Work Results for Plumbing
4. Section 220700 - Plumbing Insulation: Product and installation requirements for insulation for valves.
5. Section 221005 – Plumbing Piping: Product and installation requirements for piping materials applying to various system types.

1.2 REFERENCES

A. ASTM International:
1. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
2. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 67 - Butterfly Valves.
2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

C. Safe Drinking Water Act:
1. SDWA 1417 - Reduction of Lead in Drinking Water.

1.3 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - General Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves

C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.

B. All valves installed on the domestic water distribution system shall comply with SDWA 1417. Exception shall be main shut-off valve at domestic water service entrance that is 2-inches or larger.

C. All valve manufacturers shall demonstrate that valve products have been certified per NSF/ANSI Standard 372.

D. All valves installed on the domestic water system shall have labeling of lead content engraved on the valve body.

E. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by Victaulic or an Engineer Approved Equal

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - General Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Division 01 – General Requirements: Environmental conditions affecting products on site.

B. Do not install valves underground when bedding is wet or frozen.

1.9 WARRANTY

A. Division 01 – General Requirements: Requirements for warranties.

B. Furnish five year manufacturer warranty for valves excluding packing.

PART 2 PRODUCTS

2.1 GATE VALVES

A. Manufacturers:
1. Apollo
2. Milwaukee Valve Co.
3. NIBCO, Inc.
4. American Valve Co.
5. Watts
6. Division 01 – General Requirements

B. 2 inches and Smaller: MSS SP 80, Class 300, bronze body, bronze trim, lead free, threaded bonnet, non-rising stem, hand-wheel, inside screw, solid wedge disc, solder ends, Milwaukee Valve Company Model # UP115.

C. 2 1/2 inches and Larger: MSS SP 70, Class 175, cast iron body, bronze trim, bolted bonnet, rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends, Milwaukee Valve Company F-2885-FP. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.2 BALL VALVES

A. Manufacturers:
1. Apollo
2. Milwaukee Valve Co.
3. NIBCO, Inc.
4. American Valve Co.
5. Watts
6. Division 01 – General Requirements

B. 2 inches and Smaller: MSS SP 110, Class 600, bronze, three piece body, lead free, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder ends, lever handle, Milwaukee Valve Company Model #UPBA350S.

2.3 BUTTERFLY VALVES

A. Manufacturers:
1. Victaulic
2. Milwaukee Valve Company
3. NIBCO, Inc.
4. American Valve Co.
5. Watts
6. Division 01 – General Requirements

B. 2-inches and Larger: MSS SP 67, Class 200.
1. Body: Cast bronze, lug ends, stainless steel stem, extended neck.
2. Disc: Aluminum bronze.
3. Seat: Resilient replaceable EPDM or Fluoroelastomer.
4. Handle and Operator: 10 position lever handle. Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.
5. Milwaukee Valve Company Model # ML 233E.

C. 2-inches and Larger: MSS SP 67, Class 200.
1. Body: Ductile iron, lug ends, stainless steel stem, extended neck.
2. Disc: Aluminum bronze.
3. Seat: Resilient replaceable EPDM .
4. Handle and Operator: 10 position lever handle. Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.
5. Lead free.
6. Milwaukee Valve Company Model # ML 233E.

D. D. 2-1/2 inches and Larger: MSS SP 67, 300 CWP.
1. Body: Cast bronze, grooved ends
2. Disc: Offset ductile iron
3. Seat: Resilient replaceable Flouroelastomer
4. Handle and Operator: 10 position lever handle. Furnish chain-wheel operators for valves mounted over 8 feet above floor
5. Victaulic Model #608N.

2.4 CHECK VALVES

A. Spring Loaded Check Valves:
1. Manufacturers:
   a. Apollo
   b. Milwaukee Valve Company
   c. NIBCO, Inc.
   d. American Valve Co.

e. Watts
f. Division 01 – General Requirements

2. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Teflon disc, integral seat, solder or threaded ends.
3. 2-1/2 inches and Larger: MSS SP 125, Class 125, lead free, wafer style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends, Nibco Model # F-910-LF.

2.5 GLOBE VALVES

A. Up to and including 2-inch:
1. Bronze body, bronze trim, screwed bonnet, non-asbestos packing, rising stem, handwheel, inside screw, renewable composition disc and bronze seat, Class 125,

B. Over 2-inch:
1. Iron body, bronze trim, bolted bonnet, rising stem, non-asbestos packing, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, Class 125, flanged ends, MSS-SP-85. Provide chain wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.6 WATER PRESSURE REDUCING VALVES

A. Watts Model 223:
1. Up to 2 Inches: Bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, threaded ends, with strainer.
2. Over 2 Inches (50 mm): Cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged, with strainer, MSS-SP-80.

2.7 TEMPERATURE AND PRESSURE RELIEF VALVES

A. Watts Model 40, 140, N240, 340:
1. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

2.8 STRAINERS

A. Watts series 77:
1. Size 2 inch and Under: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
2. Size 2-1/2 inch to 4 inch: Flanged cast iron body, Class 125 for 200 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.9 FLOW CONTROL VALVES

A. FDI Series ICSS.
1. Construction: series 300 stainless steel body with nickel plated union nut.
2. Threaded inlet and outlet connection.
3. Automatic flow cartridge, stainless steel with machined piston, stainless steel spring, factory set calibration.
4. Maximum operating temperature: 180 degrees F.
5. NSF 61 certification.

B. Victaulic/TA Series 76X:
   1. Construction: series 300 stainless steel body with nickel plated union nut.
   2. Threaded inlet and outlet connection.
   3. Automatic flow cartridge, stainless steel with machined piston, stainless steel spring, factory set calibration.
   4. Maximum operating temperature: 180 degrees F.
   5. NSF 61 certification.

2.10 BALANCING VALVES

A. Bell & Gossett CB Series:
   1. Construction: Brass or bronze body with union on inlet, temperature and pressure test plug on inlet and outlet.
   2. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control.

2.11 BACKFLOW PREVENTERS

A. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013, AWWA C506; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; test cocks, Watts 909 or equal.

2.12 THERMOSTATIC MIXING VALVES

A. Manufacturers: Watts LFUSG-B

B. Other acceptable manufacturers offer equivalent products:

   1. Lawler
   2. Leonard
   3. Powers
   4. Simmonds

C. Accessories:

   1. Check valves on inlets.
   2. Volume control shut-off valve on outlet.
   3. Stem thermometer on outlet.
   4. Strainer stop checks on inlets.

D. Temp control thermostatic controller with swivel action check stops, removable cartridge with strainer, stainless steel piston and liquid filled motor with bellows mounted out of water, rough brass finish

E. Valve body: lead free bronze or brass.

2.13 PLUG VALVES

A. Manufacturers:
   1. DeZURIK, Unit of SPX Corp.
   2. Flow Control Equipment, Inc.
   3. Homestead Valve
   4. Milliken Valve Co.
   5. Substitutions: Division 01 – General Requirements

B. 2 inches and Smaller: MSS SP 78, Class 300, semi-steel construction, rectangular port, full pipe area, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

C. 2-1/2 inches and Larger: MSS SP 78, Class 300, semi-steel construction, rectangular port, full pipe area, pressure lubricated, teflon packing, flanged ends. Furnish wrench-operated.

2.14 EMERGENCY GAS SOLENOID VALVE

A. Manufacturers:
   1. Asco.
   2. DeZURIK, Unit of SPX Corp.
   3. Tufline.
   4. Substitutions: Division 01 – General Requirements

B. Die-cast aluminum body, Buna “N: seals and discs, 430F stainless steel core and plugnut, 305 stainless steel core tube, 320 stainless steel springs, copper shading coil, zinc plated steel plugs and threaded ends.

C. Operator: Solenoid enclosure, red hat metal type 1 general purpose junction box.

D. Zero differential, internal pilot-operated diaphragm valve incorporating a double disc arrangement.

E. Electrical: Standard coil 120 volts, 60 Hz.

F. Gas valve shall be provided as a normally closed, power open type valve.

2.15 GAS REGULATORS

A. Manufacturers:
   1. Equimeter.
   2. DeZurik.
   3. Maxitrol.
   4. Substitutions: Division 01 – General Requirements

B. Cast iron body (ASTM A126) spring adjustment, Buna-N soft seat, aluminum orifices, die cast aluminum alloy diaphragm case, vent valve and seal cap.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 – General Requirements: Verification of existing conditions before starting work.

B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4 inch [gate] [ball] valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08 - Openings.

F. Refer to Section 22 05 00 for pipe hangers.

G. Refer to Section 22 07 00 for insulation requirements for valves.

H. Refer to Section 22 10 05 for piping materials applying to various system types.

I. For installation of valves in swimming pool systems refer to Pool Design Drawings

3.3 VALVE APPLICATIONS

A. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install butterfly or globe valves for throttling, bypass, or manual flow control services.

D. Install spring loaded check valves on discharge of water pumps.

E. Install lug or grooved end butterfly valves adjacent to equipment when functioning to isolate equipment.

F. Install flow control valves at the remote part of the domestic hot water return system as shown on the drawings. Valve size shall be minimum of 3/4-inch

G. Provide line sized isolation valves on all domestic water branches greater than ¾” when more than two fixtures are supplied.

H. Install ball valves in domestic water systems for shut-off service.

I. Install butterfly valves in domestic water systems for throttling service.

END OF SECTION

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Formed steel channel.
6. Equipment bases and supports.

B. Related Sections:
1. Division 03- Concrete Section 23 04 00 – General Conditions for Mechanical Trades
2. Division 07 - Thermal and Moisture Protection
3. Division 09- Finishes
4. Section 22 04 00 – General Conditions for Plumbing Trades
5. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment:

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

F. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 1479 - Fire Tests of Penetration Firestops.
   4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   5. UL - Fire Resistance Directory.

1.3 SUBMITTALS

A. Division 01 - General Requirements

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data: Submit manufacturers catalog data including load capacity.

D. Manufacturer's Installation Instructions: Submit special procedures and assembly of components.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing Work of this section with minimum 3 years of experience.

1.6 PRE-INSTALLATION MEETINGS

A. Division 01 - General Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01- General Requirements.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - General Requirements.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Globe Pipe Hanger Products Inc.
2. Anvil International
3. Empire Industries
4. Hilti Inc.
5. Substitutions: Division 01- General Requirements

B. Plumbing Piping - DWV:
1. Conform to ASME B31.9, ASTM F708, or MSS SP 58.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

C. Plumbing Piping - Water:
1. Conform to ASME B31.9, ASTM F708, or MSS SP 58.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated, Carbon-steel ring.

D. Natural Gas Piping:
1. Conform to MSS SP 58.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.

6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded as required by application.

2.3 INSERTS

A. Manufacturers:
1. HiltiInc.
2. Anvil International
3. Eaton
4. 3M
5. Substitutions: Refer to Division 01 – General Requirements.

B. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Refer to Division 07 - Thermal and Moisture Protection

2.5 SLEEVES

A. Manufacturers:
1. Flexicraft Industries; Pipe Wall Sleeve
2. Metraflex; Pipe Wall Sleeve
3. CCI Pipeline; Pipe Wall Sleeve
4. GPT – Centuryline Sleeve Series
5. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Vertical Piping:
1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

C. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D. Pipe Passing Through Below Grade or Exterior Walls:
1. Anchored Sleeve - Zinc coated or cast iron pipe.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

E. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814-13A in accordance with Division 07 Thermal and Moisture Protection to prevent the spread of fire, smoke, and gases.

F. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.

G. Sleeves for Pipes through Non-fire Rated Walls, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

H. Sealant: refer to Division 07 Thermal and Moisture Protection.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. Thunderline Link-Seal, Inc.
   2. NMP Corporation
   3. Fernco
   4. BWM
   5. Substitutions: Refer to Division 01 – General Requirements.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

C. Provide NSF 61 certified assembly when used in potable water storage tank applications.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:
   1. Allied Tube & Conduit Corp.
   2. B-Line Systems
   3. Midland Ross Corporation, Electrical Products Division
   4. Unistrut Corp.
   5. Substitutions: Refer to Division 01 – General Requirements

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - General Requirements.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing and damming materials to arrest liquid material leakage.]

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut [above] [flush with top of] [recessed into and grouted flush with] slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, or MSS SP 58.

B. Support horizontal piping as scheduled.

C. All pipe hangers and supports shall be sized in accordance with the manufacturer's guidelines to support the piping based on final layout coordinated by the contractor.

D. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

E. Place hangers within 12 inches of each horizontal elbow.

F. Use hangers with 1-1/2 inch minimum vertical adjustment.

G. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

H. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

I. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

J. Support riser piping independently of connected horizontal piping.

K. Provide copper plated hangers and supports for copper piping.

L. Design hangers for pipe movement without disengagement of supported pipe.

M. Prime coat exposed steel hangers and supports. [Refer to Section 09 90 00.] Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

N. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00 Provide supplemental angles, channels and formed steel supports to support piping, ductwork, equipment, etc. from building's structure. Piping, ductwork, equipment, etc. shall not be supported from the roof deck.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping padsof concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment. Refer to Division 01

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members, formed steel channel.[or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 21 05 48.

3.6 INSTALLATION - FLASHING

A. Refer to Division 08 - Openings

B. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

C. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

D. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

E. Seal floors,showers, and mop sinkdrains watertight to adjacent materials.

F. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with stuffing,and firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel,, or stainless steel escutcheons at finished surfaces.

3.8 FIELD QUALITY CONTROL

A. Refer to Division 01 - Quality Requirements and Execution and Closeout Requirements.

3.9 CLEANING

A. Refer to Division 01 - Execution and Closeout Requirements:

3.10 PROTECTION OF FINISHED WORK

A. Refer to Division 01 Execution and Closeout Requirements

3.11 SCHEDULES

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Brass	6	1/2
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
CPVC, 1 inch and smaller	3	1/2
CPVC, 1-1/4 inches and larger	4	1/2
Copper Tube and Pipe, 1-1/4 inches and smaller	6	1/2
Copper Tube and Pipe, 1-1/2 inches and larger	10	1/2
PEX	2	1/2
PVC 1 1/2 inch and smaller	3	3/8
PVC 2 inch and larger	4	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

END OF SECTION

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 INTENT

A. All plumbing equipment and piping as noted on the equipment schedule or in the specification shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.

B. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.

C. It is the intent of the seismic portion of this specification to keep all mechanical and electrical building system components in place during a seismic event.

D. All such systems must be installed in strict accordance with seismic codes, component manufacturer's recommendations and building construction standards. Whenever a conflict occurs between the manufacturer's recommendations or construction standards, the most stringent shall apply.

E. This specification is considered to be minimum requirements for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements (i.e. California Title 24, California OSHPD, Canadian Building Codes, or other requirements).

F. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.

1.2 SUMMARY

A. Section Includes:
   1. Certification of seismic restraint designs and installation supervision.
   2. Certification of seismic attachment of housekeeping pads.
   3. NOTE: For all mechanical and electrical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included.
   4. Seismic restraint products
      a. Vibration isolation elements.
      b. Equipment isolation bases.
      c. Piping flexible connections.
      d. Seismic restraints for isolated and non-isolated mechanical and electrical items.
   5. Inertia bases.

B. Related Sections:
   1. Division 01 – General Requirements

2. Division 03 – Concrete: [Execution requirements for placement of isolators in floating floor slabs specified by this section and] product requirements for concrete for placement by this section.
3. Division 07 – Thermal and Moisture Protection: Product requirements for joint sealers specified for placement by this section.
4. Section 220400 – General Conditions for Plumbing Trades
5. Section 220500 – Common Work Results for Plumbing: Product requirements for pipe hangers and supports.

1.3 REFERENCES

A. American National Standards Institute:
1. ANSI S1.4 - Sound Level Meters.
2. ANSI S1.8 - Reference Quantities for Acoustical Levels.
3. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.

B. Air-Conditioning and Refrigeration Institute:
1. ARI 575 - Method of Measuring Machinery Sound within Equipment Space.

C. American Society of Heating, Refrigerating and:
1. ASHRAE Handbook - HVAC Applications.

1.4 RELATED WORK

A. Housekeeping Pads
1. Housekeeping pad reinforcement and monolithic pad attachment to the structure details and design shall be prepared by the restraint vendor if not already indicated on the drawings.
2. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.

B. Supplementary Support Steel
1. Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc. including roof mounted equipment, as required or specified.

C. Attachments
1. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor's calculations.

1.5 PERFORMANCE REQUIREMENTS

A. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping.

B. Provide minimum static deflection of isolators for equipment as follows:
1. Upper Floors, Normal
a. Under 400 rpm: 3.5 inch

b. 400 - 600 rpm: 3.5 inch
c. 600 - 800 rpm: 2 inch
d. 800 - 900 rpm: 1 inch
e. 1100 - 1500 rpm: 0.5 inch
f. Over 1500 rpm: 0.2 inch

2. Upper Floors, Critical
   a. Under 400 rpm: 4 inch
   b. 400 - 600 rpm: 4 inch
   c. 600 - 800 rpm: 3.5 inch
   d. 800 - 900 rpm: 2 inch
   e. 1100 - 1500 rpm: 1 inch
   f. Over 1500 rpm: 0.5 inch

C. Consider upper floor locations critical unless otherwise indicated.

D. Use concrete inertia bases for motors in excess of 40 hp and on base mounted pumps over 10 hp.

E. Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.

F. Maintain rooms at following maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE Handbook., HVAC Applications.
1. Offices
   a. Executive: 25
   b. Conference rooms: 25
   c. Private: 30
   d. Open-plan areas: 35
   e. Computer/business machine areas: 40
   f. Public circulation: 40
   g. Multi-purpose areas: 35

1.6 DEFINITIONS

A. Life Safety Systems:
1. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flow paths to fire protection and/or emergency lighting systems.
2. All medical and life support systems.
3. Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.

B. Positive Attachment:
1. A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable trays, or any other equipment are not acceptable on this project as seismic anchor points.

C. Transverse Bracing:

1. Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.

D. Longitudinal Bracing:
1. Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.

E. Failure
1. For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8" (3mm) and/or horizontal permanent deformation greater that 1/4" (6mm).

1.7 SUBMITTALS

A. Division 01 – General Requirements: Submittal procedures.

B. Shop Drawings:
1. Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
2. Provide Drawings showing methods of suspension and support guides for conduit, piping and ceiling hung equipment.
3. Record actual locations and installation of vibration isolators and seismic restraints including attachment points.
4. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.
5. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
6. Drawings showing methods for isolation of conduits and pipes penetrating walls and floor slabs.
7. Specific details of restraints including anchor bolts for mounting and maximum loading at each location, for each piece of equipment and/or pipe locations.

C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.

D. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.

1.8 CLOSEOUT SUBMITTALS

A. Division 01 – General Requirements: Closeout procedures.

1.9 QUALITY ASSURANCE

A. Perform Work in accordance with ARI 575 or ANSI S12.36.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall have the following responsibilities:
   1. Determine vibration isolation and seismic restraint sizes and locations per specifications.
   2. Provide and install isolation systems and seismic restraints as scheduled or specified.
   3. Guarantee specified isolation system deflection.
   4. Provide installation instructions, drawings and field supervision to assure proper installation and performance.
   5. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.
   6. Substitution of "Internally Isolated" plumbing equipment in lieu of the specified isolation of this section is acceptable

PART 2 PRODUCTS

2.1 INERTIA BASES

A. Manufacturers:
   1. Mason
   2. Vibration Eliminator
   3. Vibro-Acoustics Ltd.
   4. Substitutions: Division 01 – General Requirements

B. Structural Bases:
   1. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
   2. Construction: Welded structural steel with gusset brackets, supporting equipment and motor with motor slide rails.

C. Concrete Inertia Bases:
   1. Mass: Minimum of 1.5 times weight of isolated equipment.
   2. Construction: Structured steel channel perimeter frame, with gusset brackets and anchor bolts, adequately reinforced, concrete filled.
   3. Connecting Point: Reinforced to connect isolators and snubbers to base.
   4. Concrete: Reinforced 3,000 psi concrete.

2.2 VIBRATION ISOLATORS

A. Manufacturers:
   1. Mason
   2. Vibration Eliminator
   3. Amber Booth
   4. Substitutions: Division 01 – General Requirements

B. Open Spring Isolators:
   1. Spring Isolators:
      a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
      b. Code: Color code springs for load carrying capacity.
   2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
   3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
   4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.

C. Restrained Spring Isolators:
   1. Spring Isolators:
      a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
      b. Code: Color code springs for load carrying capacity.
   2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
   3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
   4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
   5. Restraint: Furnish mounting frame and limit stops.

D. Closed Spring Isolators:
   1. Spring Isolators:
      a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
      b. Code: Color code springs for load carrying capacity.
   2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
   3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
   4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.

E. Restrained Closed Spring Isolators:
   1. Spring Isolators:
      a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
      b. Code: Color code springs for load carrying capacity.
   2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.

3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.

F. Spring Hanger:
1. Spring Isolators:
a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
b. Code: Color code springs for load carrying capacity.
2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Housings: Incorporate [neoprene isolation pad meeting requirements for neoprene pad isolators] [rubber hanger with threaded insert].
4. Misalignment: Capable of 20 degree hanger rod misalignment.

G. Neoprene Pad Isolators:
1. Rubber or neoprene-waffle pads.
a. 30 durometer.
b. Minimum 1/2 inch thick.
c. Maximum loading 40 psi.
d. Height of ribs: not to exceed 0.7 times width.
2. Configuration: [Single layer.] [1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.]

H. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.

I. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 – General Requirements: Coordination and project conditions.

B. Verify equipment and piping is installed before work in this section is started.

3.2 EXISTING WORK

A. Provide access to existing piping and equipment and other installations remaining active and requiring access.

B. Extend existing piping installations using materials and methods [compatible with existing installations].

3.3 INSTALLATION

A. Install isolation for motor driven equipment.

B. Bases:
   1. Set steel bases for 1 inch clearance between housekeeping pad and base.
   2. Set concrete inertia bases for 2 inch clearance between housekeeping pad and base.

C. Adjust equipment level.

D. Install spring hangers without binding.

E. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

F. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

G. Provide pairs of horizontal limit springs on fans with more than 6.0 inch static pressure, and on hanger supported, horizontally mounted axial fans.

3.4 FIELD QUALITY CONTROL

A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect isolated equipment after installation and submit report. Include static deflections.

C. After start-up, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to plumbing equipment rooms, duct and pipe shafts, and other critical locations. Provide one-third octave band measurements of artificial sound sources in areas indicated as having critical requirements. Submit complete report of test results including sound curves.

3.5 SCHEDULES

A. Pipe Isolation Schedule:

Pipe Size Inch	Isolated Distance from Equipment
1	120 diameters
2	90 diameters
3	80 diameters
4	75 diameters
6	60 diameters
8	60 diameters
10	54 diameters
12	50 diameters
16	45 diameters

3.6 VIBRATION ISOLATION INSTALLATION

A. Horizontal pipe isolation: The first three pipe hangers in the main lines near the mechanical equipment shall be as described in specification 11. Specification 11 hangers must also be used in all transverse braced isolated locations. Brace hanger rods with SRC clamps specification 14. Horizontal runs in all other locations throughout the building shall be isolated by hangers as described in specification 10. Floor supported piping shall rest on isolators as described in specification 6. Heat exchanger's and expansion tanks are considered part of the piping run. The first three isolators from the isolated equipment will have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75" deflection for pipe sizes up to and including 3", 1 1/2" deflection for pipe sizes up to and including 6", and 2 1/2" deflection thereafter. Hangers shall be located as close to the overhead structure as practical. Where piping connects to mechanical equipment install specification 23 expansion joints or specification 24 stainless hoses if 23 is not suitable for the service.

B. Riser isolation: Risers shall be suspended from specification 10 hangers or supported by specification 5 mountings, anchored with specification 25 anchors, and guided with specification 26 sliding guides. Steel springs shall be a minimum of 0.75" except in those expansion locations where additional deflection is required to limit load changes to $\pm$ 25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

C. Vibration Isolation of Plumbing Equipment
   1. All equipment shall be vibration isolated as per the schedules in part 3.5 of this specification.
   2. Equipment mounted on housekeeping pads: Pads shall be properly doweled or expansion shielded to deck to meet acceleration criteria.
   3. Requirements for installation on concrete inertia bases shall be as follows:
      a. Minimum operating clearance between concrete inertia and base and housekeeping pad or floor shall be 2".
      b. The equipment structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the machine or isolators.
      c. The isolators shall be installed without raising the machine and frame assembly.
      d. After the entire installation is complete and under full operational load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
      e. Install equipment with flexibility in wiring connection.
      f. Verify that all installed isolator and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 1/4".
      g. Prior to start-up, clean out all foreign matter between bases and equipment. Verify that there are no isolation short circuits in the base, isolators, or seismic restraints.

3.7 INSPECTION

A. Examine systems under provisions of Division 01.

B. On completion of installation of all vibration isolation devices herein specified, the local representative shall inspect the completed system and report in writing any installation error, improperly elected isolation devices, or other faults in the system that could affect the performance of the system. Contractor shall submit a report to the Owner, including the manufacturers representatives' final report, indicating all isolation reported as properly installed or requiring correction, and include a report by the Contractor on steps taken to properly complete the isolation work.

END OF SECTION

SECTION 220700 - PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plumbing piping insulation, jackets and accessories.
2. Plumbing equipment insulation, jackets and accessories.

B. Related Sections:
1. Division 01 General Requirements
2. Division 07 - Firestopping
3. Division 09 - Finishes

1.2 REFERENCES (follow the most currently adopted amended version)

A. ASTM International:
1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless
2. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
5. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
6. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
7. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
8. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
9. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
10. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
11. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
12. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
13. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
14. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
15. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.
16. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
17. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
18. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

19. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
20. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation.
21. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber.
22. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
23. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
24. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
25. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
26. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
27. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. Underwriters Laboratories Inc.:
1. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Division 01 – General Requirements

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and installation standards will be achieved.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

B. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

D. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping. Store all insulation materials in a clean, dry environment.

1.6 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements.

1.9 SCHEDULING

A. Schedule insulation application after pressure and leak testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency. Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 MANUFACTURER

A. Manufacturers for Closed Cell Elastomeric (CCE) Pipe Insulation Products:
   1. Armacell LLC - AP Armaflex 25/50
   2. Aeroflex USA, Inc – Aerocel –SSPT w/SaniGuard
   3. K-Flex USA LLC – Insul-tube
   4. Substitutions: See Division 01 – General Requirements.

2.3 PIPE INSULATION

A. Closed Cell Elastomeric (CCE) Pipe Insulation:
   1. Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 3; use molded tubular material wherever possible.
   2. 'K' Value: ASTM C177, between 0.21 and 0.27 at mean rating temperature of 75 degrees F
   3. Minimum Service Temperature: Minus 40 degrees F
   4. Maximum Service Temperature: 220 degrees F
   5. Connection: Waterproof vapor barrier adhesive.

6. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: hydrous calcium silicate. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.

F. Valve insulation Wraps: White, noncombustible, conforming to ASTM E 84. Match insulation thickness to pipe size. Valve covers shall be easily removable.

2.5 EQUIPMENT INSULATION

A. Pre-Molded Glass Fiber (PGF) Equipment Insulation:
1. ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.
2. Thermal Conductivity: 0.24 at 75 degrees F
3. Operating Temperature Range: 0 to 450 degrees F
4. Density: 3 pound per cubic foot

B. Closed Cell Elastomeric (CCE) Equipment Insulation:
1. ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
2. 'K' Value: ASTM C177, between 0.21 and 0.27 at mean rating temperature of 75 degrees F
3. Operating Temperature Range: Range: Minus 70 to 220 degrees F

2.6 EQUIPMENT INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

E. Adhesives: Compatible with insulation. Refer to manufacturers' installation manual.

PART 3 EXECUTION

3.1 EXAMINATION

A. Protect insulation from exposure to moisture prior to and after installation. All insulation other than flexible elastomeric that becomes wet shall be replaced at no cost to the project.

B. Verify that piping and equipment has been tested before applying insulation materials.

C. Verify that piping and equipment surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Piping and fittings exposed to view: Provide with PVC Plastic pipe jacketing and fittings for additional protection. Locate insulation and cover seams in least visible locations.

D. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 for penetrations of assemblies with fire resistance rating greater than one hour.

E. Insulated pipes conveying fluids below ambient temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.

F. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

G. Pre-molded Glass Fiber (PFG) insulated pipes conveying fluids above or below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.

H. For hot piping conveying fluids, insulate flanges and unions at equipment.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or

less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. . Refer to Section 07 – Thermal and Moisture Protection for penetrations of assemblies with fire resistance rating greater than one hour.

J. Buried Piping: Provide closed cell elastomeric insulation with all-purpose service jacket with self-sealing lap.

K. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer and according to the heat trace manufacturer's installation instructions. Verify required thickness with heat trace manufacturer's installation instructions. Cover with aluminum jacket with seams located on bottom of horizontal piping.

L. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

M. Closed Cell Elastomeric (CCE) Insulation:
1. Push insulation on to piping.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer's recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

N. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Containing Fluids Below Ambient Temperature:
1. Insulate entire equipment surfaces.
2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
4. Finish insulation at supports, protrusions, and interruptions.

E. Equipment Containing all Fluids Above Ambient Temperature:
   1. Insulate flanges and unions with removable sections and jackets.
   2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
   3. Finish insulation at supports, protrusions, and interruptions.

F. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

G. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.4 PIPE INSULATION SCHEDULE

A. Provide insulation materials and thicknesses scheduled for each system type and pressure/temperature range. If more than one material is listed for a system, selection from materials listed is Division 22 option.

B. Insulation for pre-insulated piping shall meet all specified requirements.

C. Insulation thickness shall be coordinated with heat trace manufacturers' installation instructions. Listed sizes on schedule shall be used as minimum sizes only.

Domestic Hot Water Supply and Recirculation Systems				
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Closed Cell Elastomeric (CCE)	1-1/4 inches and smaller	1.0	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.
	1-1/2 inches and larger	1.5		

Sanitary and Storm PVC Systems: Vertical Above Ground Within Building				
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-Molded Glass Fiber (PFG)	All Sizes	0.5	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms. Outdoor: ALM
Closed Cell Elastomeric	All Sizes	0.5	ASJ-SSL	Indoor: PVC for

(CCE)				exposed piping finished space and mechanical rooms. Outdoor: ALM

Domestic Hot Water Storage Tank			
Insulation Type	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-molded Glass Fiber (PFG)	1.5	N/A	Indoor: N/A Outdoor: ALM
Closed Cell Elastomeric (CCE)	1.5	N/A	Indoor: N/A Outdoor: ALM

Domestic Water Storage Tank			
Insulation Type	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-molded Glass Fiber (PFG)	1.0	N/A	Indoor: N/A Outdoor: ALM
Closed Cell Elastomeric (CCE)	1.0	N/A	Indoor: N/A Outdoor: ALM

END OF SECTION

SECTION 221005 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Chemical resistant sewer.
   3. Domestic water.
   4. Storm water.
   5. Flanges, unions, and couplings.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements.

B. Division 08 – Openings.

C. Division 07 - Thermal and Moisture Protection

D. Division 09 - Finishes.

E. Section 22 0400 – General Conditions for Plumbing Trades.

F. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.

G. Section 22 0719 - Plumbing Piping Insulation.

H. Division 26 – Electrical: Electrical characteristics and wiring connections.

I. Division 31 - Earthwork

J. Division 33 - Utilities.

1.3 REFERENCE STANDARDS – Most Currently adopted versions and amendments for the location of the project.

A. American National Standards Institute
   1. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; and addenda A&B.
   2. ANSI Z223.1 - National Fuel Gas Code.

B. American Society of Mechanical Engineers
   1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.
   3. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250.
   4. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   5. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
   6. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.

7. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
8. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
9. ASME B31.9 - Building Services Piping.
10. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers.
11. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications.

C. American Society of Sanitary Engineering
1. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems.

D. American Society for Testing and Materials
1. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
6. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
7. ASTM B32 - Standard Specification for Solder Metal.
8. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
9. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
10. ASTM B68 - Standard Specification for Seamless Copper Tube, Bright Annealed.
11. ASTM B75 - Standard Specification for Seamless Copper Tube.
12. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
13. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.
14. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
15. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
16. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
17. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
18. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
19. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
20. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
21. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
22. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings.
23. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

24. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
25. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
26. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
27. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
28. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
29. ASTM D2846 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
30. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
31. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
32. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
33. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
34. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
35. ASTM F441 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
36. ASTM F442 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
37. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
38. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
39. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
40. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
41. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
42. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.
43. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe;.
44. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
45. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.

E. American Welding Society
1. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
2. AWS D1.1 - Structural Welding Code - Steel;.

F. American Water Works Association
1. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

2. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.
3. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
5. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
6. AWWA C606 - Grooved and Shouldered Joints.
7. AWWA C651 - Disinfecting Water Mains.
8. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Transmission and Distribution; 2016.
9. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service.

G. Cast Iron Soil Pipe Institute
1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

H. International Code Council
1. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Element.
2. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.
3. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements.
4. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

I. Manufacturers Standardization Society
1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
2. MSS SP-67 - Butterfly Valves.
3. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 20DA.
   MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.
7. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

J. National Sanitation Foundation
1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

K. National Fire Protection Association
1. NFPA 54 – Natural Gas Code
2. NFPA 58 – Liquefied Petroleum Gas Code.

L. Plastic Pipe Institute
1. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe.

1.4 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welder Certificate: Include welder's certification of compliance with ASME BPVC-IX.

D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

E. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

F. Project Record Documents: Record actual locations of valves.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Division 01 -General Requirements.
2. Valve Repacking Kits: One for each type and size of valve.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 10 FEET OF BUILDING

A. PVC Pipe: ASTM 1784 or ASTM D3034 (SDR 35).
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.4 SANITARY SEWER PIPING, CHEMICAL RESISTANT (POOL AND POOL EQUIPMENT AREAS)

A. PVC Pipe: ASTM 1784 or ASTM D3034 (SDR 35).
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.
3.

2.5 DOMESTIC WATER PIPING, BURIED WITHIN 10 FEET OF BUILDING

A. Copper Pipe: Type L ASTM B42, hard drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
2. Joints: ASTM B32, alloy Sn95 solder.
3. Joints: AWS A5.8M/A5.8, BCuP copper/silver braze.

B. Copper Pipe: ASTM B42, annealed.
1. Fittings: ASME B16.26, cast bronze.
2. Joints: Flared.

2.6 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88, Type L.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, alloy Sn95 solder.
3. Joints: Grooved mechanical couplings.
4. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non-toxic synthetic rubber sealing elements.
a. Manufacturers:
1) Mueller Streamline Co (Mass approved manufacturer)

2) Oatey Company (Mass approved manufacturer)
3) Cambridge Lee Industries (Mass approved manufacturer)
4) JM Eagle (Mass approved manufacturer)
5) Viega LLC
6) Substitutions: Division 01- General Requirements.

2.7 STORM WATER PIPING, BURIED WITHIN 10 FEET OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.8 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.9 NATURAL GAS PIPING, UNDERGROUND, EXTERIOR TO BUILDING SLABS AND FOUNDATIONS

A. Polyethylene Pipe: ASTM D2513, SDR 11.
1. Fittings: ASTM D2683 or ASTM D2513 socket type.
2. Joints: Fusion welded.

2.10 NATURAL GAS PIPING, ABOVE GRADE AND UNDER BUILDING SLABS AND FOUNDATIONS

A. Steel Pipe: ASTM A53 Schedule 40 black.
1. Fittings: ASME B16.3, malleable iron, or ASTM A234, wrought steel welding type.
2. Joints: Threaded or welded to ASME B31.1.

2.11 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
1. Ferrous pipe: Class 150 malleable iron threaded unions.
2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
1. Dimensions and Testing: In accordance with AWWA C606.
2. Housing Material: Provide ASTM A47 malleable iron, ductile iron, or galvanized.
3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.

4. Gasket Material: Nitrile rubber suitable for operating temperature range from minus 20 degrees F to 180 degrees F.
5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
7. Manufacturers:
   a. Grinnell Products, a Tyco Business
   b. Bristol Metals (Mass approved manufacturer)
   c. Viega LLC (Mass approved Manufacturer).
   d. Victaulic Company (Mass approved manufacturer)
   e. Substitutions: Division 01 - General Requirements.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier are required where two dissimilar metal products are connected within a system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220700.

G. Provide access where valves and fittings are not exposed.
1. Coordinate size and location of access doors with Division 08 Openings.

H. Establish elevations of buried piping outside the building to ensure not less than the local area's frost depth of cover.

I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly and a minimum of 25 [10] feet from an air intake; refer to Division 08 Openings.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide support for utility meters in accordance with requirements of utility companies.

L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
   1. Painting of interior plumbing systems and components are specified in Division 09 - Finishes.
   2. Painting of exterior plumbing systems and components are specified in Division 09 - Finishes.

M. Excavate in accordance with Division 31- Earthwork requirements.

N. Backfill in accordance with Division 31 – Earthwork requirements

O. Install bell and spigot pipe with bell end upstream.

P. Install water piping to ASME B31.9.

Q. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

R. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

S. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.4 TOLERANCES

A. Sanitary Drainage Piping (except Massachusetts): slope to sanitary drain at minimum of 1/8 inch per foot.

B. Sanitary Drainage Piping (in Massachusetts): slope to sanitary drain at minimum of 1/4" per foot for horizontal piping 3" and smaller. Slope sanitary drain 1/8" per foot for horizontal piping larger than 3 inches.

C. Pressure test natural gas piping in accordance with NFPA 54.

D. Pressure test LPG piping in accordance with NFPA 58.

3.5 SYSTEM FLUSHING

A. The following system flushing criteria shall apply to all domestic water piping systems inclusive of hot water, cold water and hot water recirculation.

B. Upon completion of installation of piping, and prior to disinfection, flush the piping systems with clean, potable water until dirty water does not appear at the points of outlet.

C. Remove strainers and flow restrictors from fixtures prior to flushing and reinstall after flushing is complete

D. Mixing valves located at fixtures shall not be installed until after flushing is complete. Provide temporary bypass connections as required.

E. Provide isolation and temporary bypass piping for water heaters, expansion tanks, and other equipment.

F. Run fixtures simultaneously for a minimum of 30 minutes or until no debris is evident.

G. Flushing shall be considered satisfactory when no debris is evident after running water through a number 80 mesh screen.

H. Contractor to notify engineer and owner a minimum of 72 hours before performing flushing.

I. Once system has been successfully flushed, contractor shall provide a report to engineer documenting flushing procedure and results.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
2. Provide 18 gage, 0.0478 inch galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

END OF SECTION

SECTION 223000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water Heaters:
   1. Commercial electric.

B. Packaged water heating systems.

C. Acid neutralizers.

D. UV sterilizers.

E. In-line circulator pumps.

F. Cooling condensate removal pumps.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

1.3 REFERENCE STANDARDS See Division 01 - General Requirements

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. NEMA MG 1 - Motors and Generators.

D. NFPA 31 - Standard for the Installation of Oil Burning Equipment.

E. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. See Division 01 - Administrative Requirements, for submittals procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

C. Shop Drawings:
   1. Indicate heat exchanger dimensions, size of tappings, and performance data.
   2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Manufacturer's Instructions.

E. Project Record Documents: Record actual locations of components.

F. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Project Record Documents: Record actual locations of components.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - Product Requirements, for additional provisions.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Certifications:
   1. Water Heaters: NSF approved.
   2. Electric Water Heaters: UL listed and labeled to UL 174.
   3. Pressure Vessels for Heat Exchangers: ASME labeled to ASME BPVC-VIII-1.
   4. Water Tanks: ASME labeled to ASME BPVC-VIII-1.
   5. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

D. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.7 WARRANTY

A. See Division 01 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.1 WATER HEATERS

A. Manufacturers:

1. A.O. Smith Water Products Co; www.hotwater.com.
2. State Industries; www.hotwater.com
3. PVI Ind. www.pvi.com
4. Laars www.laars.com
5. Rheem Manufacturing Company: www.rheem.com.
6. Substitutions: See Division 01 - Product Requirements.

2.2 WATER HEATING SYSTEM COMPONENTS

A. Manufacturers:
1. Bell & Gossett, a xylem brand
2. Lochinvar LLC
3. Taco
4. Substitutions: See Division 01 - General Requirements.

B. Pump:
1. Type: All bronze, in-line circulation pump mounted on boiler, controlled by pipe mounted immersion thermostat.
2. Thermostat Setpoint: Refer to Plans
3. Pump Capacity: Refer ot Plans

C. Thermostatic Valve: Three-way, self-contained, full line size, bronze body 1/2 to 2 inches size, iron body 2-1/2 inches and over, set at 110 degrees F at each fixture.

2.3 COOLING CONDENSATE REMOVAL PUMPS

A. Manufacturers:
1. Franklin Electric Company;
2. Liberty Pumps Inc;
3. Little Giant
4. Substitutions: See Division 01 - General Requirements.

B. Construction: Commercial grade, nonferrous pump with stainless steel shaft, integral discharge check valve, integral float switch, safety switch, thermoplastic reservoir, motor assembly, and power cord with ground.

C. Safety: UL 778.

2.4 ELECTRICAL WORK

A. Provide electrical motor driven equipment specified complete with motors, motor starters, controls, and wiring.

B. Electrical characteristics to be as specified or indicated.

C. Furnish motor starters complete with thermal overload protection and other appurtenances necessary for the motor control specified.

D. Supply manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices not shown.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Pumps:
1. Ensure shaft length allows sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.
2. Provide air cock and drain connection on horizontal pump casings.
3. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
4. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
5. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
6. Align and verify alignment of base mounted pumps prior to start-up
7. Provide electrical interlocking from cooling condensate pump safety switch to associated HVAC unit(s) furnished under other Sections.

END OF SECTION

SECTION 224000 - PLUMBING FIXTURES AND SPECIALTIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Attention is directed to the following specifications sections, which are hereby made a part of this Section of the Specifications.

1. Division 01 - General Requirements
2. Division 07 – Thermal and Moisture Protection: Product requirements for calking between fixtures and building components for placement by this section.
3. Division 11 – Equipment.
4. Division 12 – Furnishings: “Plastic Laminate-Clad Countertops”
5. Division 12 – Furnishings: “Solid Surface Countertops”
6. Section 22 04 00 – General Conditions for Plumbing Trades
7. Section 22 05 00 – Common Work Results for Plumbing.
8. Section 22 05 23 – General Duty Valves for Plumbing Piping.
9. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
10. Section 22 07 00 – Plumbing Insulation.
11. Section 22 10 05 Plumbing Piping: Supply connections to plumbing fixtures.
12. Section 22 30 00 - Plumbing Equipment.
13. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.2 SUMMARY

A. Section includes the following plumbing fixtures:

1. Drinking fountains.
2. Electric water coolers
3. Janitors sinks.
4. Lavatories.
5. Showers Enclosures.
6. Shower Receptors.

7. Sinks.

8. Water closets.

B. Section includes the following plumbing specialties:

1. Area drains.

2. Cleanouts.

3. Emergency Eye and Face Wash.

4. Expansion tanks.

5. Fixture supports.

6. Floor drains.

7. Floor sinks.

8. Hose bibs.

9. Indirect waste funnel.

10. Lavatory insulation kit.

11. Plumbing traps.

12. Recessed valve boxes.

13. Roof drains.

14. Overflow drains.

15. Combination roof/overflow drains.

16. Grease interceptors

17. Trap primers.

18. Water hammer arrestors.

19. Stops

1.3 REFERENCES

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. American National Standards Institute:

1. ANSI 61 - Drinking Water System Components
2. ANSI A112.21.1 - Floor Drains.
3. ANSI A112.21.2 - Roof Drains.
4. ANSI A112.26.1 - Water Hammer Arrestors.
5. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
6. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.
7. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.
8. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

C. Air-Conditioning and Refrigeration Institute:

1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

D. American Society of Mechanical Engineers:

1. ASME A112.6.3 – Floor and Trench Drains
2. ASME A112.6.4 – Roof, Deck, and Balcony Drains
3. ASME A112.18.1 - Plumbing Supply Fittings.
4. ASME A112.18.1M – Plumbing Fixture Fittings.
5. ASME A112.18.2 – Plumbing Waste Fittings.
6. ASME A112.19.1 - Enameled Cast Iron and Enameled Steel Plumbing Fixtures.
7. ASME A112.19.2 - Ceramic Plumbing Fixtures.
8. ASME A112.19.3 - Stainless Steel Plumbing Fixtures
9. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures.
10. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks.
11. ASME A112.19.19 Vitreous China Non-water Urinals
12. ASME A112.6.1 - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
13. ASME A112.36.2M – Cleanouts.

E. American Society of Testing and Materials

1. ASTM A888-20 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

2. ASTM A48/A48M - Standard Specification for Gray Iron Castings.

3. ASTM F409 – Standard Specifications for Thermoplastic and Replaceable Plastic Tube and Tubular Fittings.

4. ASTM F2649-14 - Standard Specification for Corrugated High Density Polyethylene (HDPE) Grease Interceptor Tanks

5. ASTM D-4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials

F. American Society of Safety Engineers

1. ASSE 1016/ASME A112.1016/CSA B125.16-11, Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations

2. ASSE 1017, Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems

3. ASSE 1062, Performance Requirements for Temperature Actuated Flow Reduction (TAFR) Valves for Individual Fixture Fittings

4. ASSE 1066, Performance Requirements for Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings

5. ASSE 1069, Performance Requirements for Automatic Temperature Control Mixing Valves

6. ASSE 1070/ASME A112.1070/CSA B125.70-15, Performance Requirements for Water Temperature Limiting Devices

7. ASSE 1071, Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment

G. American Society of Heating, Refrigeration and Air Conditioning Engineers:

1. ASHRAE Std 18 - Methods of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration.

H. International Association of Plumbing and Mechanical Officials:

1. IAPMO IGC 187 – Roof Drains with Integral Overflow Drain.

2. IAPMO Z124 - Plastic Plumbing Fixtures.

3. IAPMO Z403-13 - Terrazzo, Concrete, and Natural Stone Plumbing Fixtures

I. International Surface Fabricators Association

1. ISFA 2-01 – Classification and Standards for Solid Surfacing Material

J. National Sanitation Foundation:

1. NSF 61 - Drinking Water System Components - Health Effects.

2. NSF 372 - Drinking Water System Components - Lead Content.

K. Plumbing Drainage institute:

1. PDI WH-201 – Water Hammer Arresters.

1.4 SUBMITTALS

A. Division 01 - General Requirements.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Samples: Submit two lavatory supply fittings fixtures for color matching.

E. Manufacturer's Installation Instructions: Submit installation methods and procedures. Indicate assembly and support requirements

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

H. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - General Requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with State of Florida standard.

B. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., as suitable for purpose specified and indicated.

C. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

D. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.8 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - General Requirements.

B. Accept products on site in factory packaging. Inspect for damage.

C. Protect installed fixtures and specialties from damage by securing areas and by leaving factory packaging in place to protect fixtures and specialties, and prevent use.

1.10 WARRANTY

A. Division 01 - General Requirements.

B. Furnish five year manufacturer warranty for plumbing fixtures.

1.11 EXTRA MATERIALS

A. Division 01 - General Requirements.

B. Furnish two sets of faucet washers flush valve service kits lavatory supply fittings shower heads toilet seats.

C. Provide two loose keys for hose bibs and wall hydrants.

PART 2 PRODUCTS

2.1 GENERAL

A. See schedule on drawings for additional requirements and accessories.

B. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 DRINKING FOUNTAINS

A. Manufacturers:

1. Elkay.

2. Hasley Taylor.

3. Oasis.

4. Substitutions: Division 01 - General Requirements.

B. All components of the drinking fountain in the wetted surface material shall be lead free in accordance with SDWA 1417.

C. Architect shall provide wall recess to install drinking fountains. Units shall not project into corridor or walkways.

2.3 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:

1. Elkay.

2. Haws.

3. Oasis.

4. Murdock.

5. Substitutions: Division 01 - General Requirements.

B. Water Cooler: ARI 1010

C. All components of the electric water cooler in the wetted surface material shall be lead free in accordance with SDWA 1417

1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F (27 degrees C) and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.

2. Electrical: 115 V, 60-Hertz compressor, 6-foot cord and plug for connection to electric wiring system including grounding connector. Refer to division 26 plans and specifications.

2.4 JANITOR SINKS

A. Manufacturers:

1. American Standard

2. Acorn

3. Fiat

4. Kohler Co.

5. Just

6. Substitutions: Division 01 - General Requirements.

B. IAPMO Z403-13; Molded stone basin and integral drain body.

C. IAPMO Z124; Plastic basin and integral drain body.

D. Supply Faucets

1. Manufacturers

a. Speakman

b. American Standard, Inc.

c. Kohler Company

d. Zurn Industries, Inc.

e. Symmons

f. T&S Brass

g. Chicago Faucets

h. Substitutions: Division 01 - General Requirements.

E. Faucet and Trim: ASME A112.18.1, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

F. Provide a combination service sink faucet and eyewash/drench hose unit, complete with thermostatic mixing valve.

2.5 LAVATORIES

A. Manufacturers:

1. American Standard

2. Bradley

3. Kohler Co.

4. Crane

5. Substitutions: Division 01 - General Requirements.

B. Basin: ASME A112.19.2; Vitreous China Wall Hung Basin: with 4 inch high back, , rectangular basin with splash lip, front overflow, and soap depression.

C. Basin: ASME A112.19.2; Vitreous China Counter Top Basin: self-rimming counter top lavatory, front overflow, soap depression, seal of putty, calking, or concealed vinyl gasket.

D. Basin: ASME A112.19.2; Vitreous China Under-Mount Basin: ASME A112.19.2; front overflow, mounting kit and template by manufacturer.

E. Basin: ASME A112.19.4M; Steel Counter Top Basin: porcelain on steel self-rimming,, front overflow, soap depression, seal of putty, calking, or concealed vinyl gasket.

F. Supply Faucets

1. Manufacturers

a. American Standard, Inc.

b. Kohler Company

c. Zurn Industries, Inc.

d. Symmons

e. T&S Brass

f. Chicago Faucets

g. Substitutions: Division 01 - General Requirements.

2. Supply Fitting: ASME A112.18.1; chrome plated supply fitting with open grid strainer, water economy aerator with maximum

3. Sensor Operated Metering Faucet: ASME A112.18.1; chrome plated with metering options.

4. Metered Faucet: ASME A112.18.1; chrome plated metered mixing faucet with low voltage operated solenoid operator and infrared sensor, aerator and cover plate.

G. For hand washing facilities, provide tempered water through regulating device conforming to ASSE 1070, or mixing valve to provide 110 Deg F at the fixture.

H. Waste Fittings: ASME A112.18.2 or ASTM F 409.

I. Accessories:

1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.

2. Perforated open strainer.

3. Screwdriver stops.

4. Rigid supplies.

5. Trap and waste insulated and offset to meet ADA compliance.

J. Wall Mounted Carrier: ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs. See drawings for additional requirements and accessories.

K. Lavatory faucet controls shall be located within 13 inches from leading edge of lavatories in accordance with federal register rules and regulations.

L. Sensor-Operated Faucets:

1. Vandal-resistant meeting requirements of ASME A112.18.1 and ADA Standards compliant.

2. Sensor Operated Metering Faucet: ASME A112.18.1; chrome plated with metering options.

3. Metered Faucet: ASME A112.18.1; chrome plated metered mixing faucet with low voltage operated solenoid operator and infrared sensor, aerator and cover plate.

4. Sensor Module: Water conserving, vandal-resistant adjustable sensor unit with timing turn-off delay and stationary object automatic timed cutoff, with hard-wired electrical connection.

5. High profile metering faucet with infrared and external temperature control.

6. Manual Faucet: ADA Standards compliant lever on faucet body.

7. Aerator: Operating range of 20 to 80 psi.

8. Body: Polished chrome plated commercial solid cast brass, with center set mounting trim plate.

9. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with stop/strainer/check valves, and flexible stainless steel connectors.

M. Waste Fittings: ASME A112.18.2 or ASTM F 409.

N. Access Panel: Stainless steel.

O. Support Frame: Wall mounted, heavy gage, stainless steel.

2.6 SERVICE SINKS

A. Service Sink Manufacturers:

1. American Standard..

2. Commercial Enameling Company

3. Elkay.

4. Gerber.

5. Just.

6. Zurn.

7. Substitutions: Division 01 - General Requirements.

B. Bowl: ASME A112.19.1; porcelain enameled (inside only) cast iron roll-rim sink, concealed hanger, chrome plated strainer, stainless steel rim guard, cast iron P-trap with adjustable floor flange.

C. Bowl: IAPMO Z403-13;white molded stone, floor mounted, with one-inch wide shoulders, vinyl bumper guard, stainless steel strainer.

D. Trim: ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

2.7 SHOWER ENCLOSURES

A. Manufacturers:

1. American Standard.

2. Bradley Corp.

3. Aquarius.

4. Lasco.

5. Aquaglass.

6. Kohler Co.

7. Comfort Designs Model.

8. Substitutions: Division 01 - General Requirements:

B. Cabinet: Tile Enclosure for base and walls by Division 01.

C. Cabinet: ANSI Z124.2 molded cast acrylic, with stone texture integral receptor, soap dish, integral seat, removable chrome plated strainer, tailpiece, color as selected. See drawings for additional requirements and accessories.

D. Cabinet: ASME A112.19.4M; porcelain enameled steel, stone texture receptor, soap dish, removable chrome plated strainer, tail piece. Color by architect.

E. Cabinet: IAPMO Z124 reinforced glass fiber, stone texture, integral receptor, soap dish, integral seat, removable chrome plated strainer, tail piece, color by architect.

F. Trim: ASME A112.18.1; concealed shower supply with indexed handles, bent shower arm with flow control and adjustable spray ball joint showerhead, and escutcheon.

G. Trim: ASME A112.18.1; concealed rough brass metering valve with closed fluid metering system adjustable from 5 to 120 seconds, chrome plated push button and escutcheon, wheel handle stop.

H. Trim: ASME A112.18.1; concealed shower supply with pressure balanced thermostatic mixing valves, integral service stops, female inlet.

I. Trim: ASME A112.18.1; concealed straight way pattern valve with indexed cross handle.

J. Low-Flow Shower Head:

1. ASME A112.18.1; chrome plated with integral wall bracket, built-in 1.5 gpm flow control.

2.8 SHOWER RECEPTORS

A Manufacturers:

a. American Standard.

b. Acorn.

c. Fiat

d. Substitutions: Division 01 - General Requirements.

B. Shower Receptors: IAPMO Z124; Solid surface, plastic resin casting, self-supporting, for installation over conventional subfloor;

1. Material: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, renewable material filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.

2. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.

3. Finish on Exposed Surfaces: Provide satin or matte, gloss rating of 3 to 20.

4. Color and Pattern: As selected by Architect from manufacturer's full line.

C. Drain Trim: Removable chrome plated strainer and tailpiece.

2.9 SINKS

A. Manufacturers:

1. American Standard.

2. Elkay.

3. Just.

4. Kohler Co.

5. Crane.

6. Substitutions: Division 01 - General Requirements.

B. Single Compartment Bowl: ASME A112.19.3; 18 gage thick, Type 302 stainless steel. Self-rimming and undercoated, with stainless steel drain 3-1/2 inch crumb cup and tailpiece, ledge back drilled for trim. See drawings for additional requirements and accessories.

C. Double Compartment Bowl: ASME A112.19.3; 18 gage thick, Type 302 stainless steel. Self-rimming and undercoated, with stainless steel drains 3-1/2 inch crumb cups and tailpieces, ledge back drilled for trim. See drawings for additional requirements and accessories.

D. Double Bowl With Bubbler: Custom Elkay sink or approved equal. Provide all accessories as noted in schedules and details.

E. Enameled Bowl: ASME A112.19.4M; steel, porcelain enameled, single compartment, outside dimensions, self-rimming and undercoated, with 3-1/2 inch diameter crumb cup and chromed brass tailpiece, ledge back drilled for trim.

F. Supply Faucets

1. Manufacturers

a. American Standard.

b. Kohler Co.

c. Zurn.

d. Symmons.

e. T&S Brass.

f. Chicago Faucets.

g. Substitutions: Division 01 - General Requirements.

2. Supply Fitting: ASME A112.18.1; chrome plated supply fitting with open grid strainer, water economy aerator with maximum

3. Sensor Operated Metering Faucet: ASME A112.18.1; chrome plated with metering options.

4. Metered Faucet: ASME A112.18.1; chrome plated metered mixing faucet with low voltage operated solenoid operator and infrared sensor, aerator and cover plate, open grid strainer.

G. For public hand washing facilities, provide tempered water through regulating device conforming to ASSE 1070.

H. Accessories: Chrome plated 17-gauge brass P-trap with clean-out plug and arm with escutcheon, screwdriver stop, and rigid supplies. Trap and waste insulated and offset to meet ADA compliance.

I. Sink faucet controls shall be located within 13 inches from leading edge of sink in accordance with federal register rules and regulations.

2.10 WATER CLOSETS – FLUSH VALVE

A. Manufacturers:

1. American Standard

2. Gerber Plumbing Fixtures LLC

3. Zurn

4. Toto

5. Kohler Co.

6. Crane

7. Substitutions: Division 01 - General Requirements

B. Bowl: ASME A112.19.2M; wall hung, vitreous china closet bowl, with elongated rim, 1-1/2 inch spud, china bolt caps.

C. Flush Valve Manufacturers:

1. Sloan

2. American Standard

3. Zurn

4. Hydrotek

5. Substitutions: Division 01 - General Requirements.

D. Sensor Operated Flush Valve: ASME A112.18.1; exposed rough brass, diaphragm type with [low voltage] [battery] operated solenoid operator, infrared sensor and over-ride button in chrome plated plate, wheel handle stop and vacuum breaker.

E. Seat: Solid white plastic, open front, extended back, brass bolts, without cover. See drawings for additional requirements and accessories.

F. Wall Mounted Carrier: ASME A112.6.1; cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.11 AREA DRAINS

A. Area Drains: ANSI A112.21.2, cast iron body, cast iron grate.

2.12 CLEANOUTS

A. Manufacturers:

1. Josam.
2. J.R. Smith.
3. Zurn.
4. Watts.
5. Wade.
6. Substitutions: Division 01 - General Requirements.

B. ASME A112.36.2M; Cleanouts: Cast iron body with adjustable scoriated nickel bronze top and vandal proof screws.

C. Interior Finished Wall Cleanouts: Line type with cast iron body, round epoxy coated gasketed cover and round stainless steel access cover secured with machine screw.

D. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide stack cleanouts on vertical rainwater leaders.

E. Cleanout plugs shall be screwed brass installed either in cast iron-caulked ferrules or directly into threaded drainage fittings. Above floor cleanouts on stacks may be "Dandy" cleanouts.

F. Refer to other Sections of the Specification for access doors which may be used in lieu of covers specified below.

G. Cleanouts are to be accessible and locations coordinated with cabinetry, shelving and other architectural details. DO NOT place cleanouts where they will not be readily accessible.

2.13 DOWNSPOUT BOOTS

A. Manufacturers:

1. Woodford.
2. Josam.
3. Wade.
4. Zurn.
5. Watts.
6. Substitutions: Division 01 - General Requirements..

B. ASTM A48/A48M; Cast Iron Body and Strap, cleanout access.

C. Coordinate size with architect.

2.14 DOWNSPOUT NOZZLES

A. ASME A112.6.4; Type 304 stainless steel body.

B. Coordinate color/finish with architect.

2.15 EMERGENCY EYE AND FACE WASH

A. Emergency Wash Manufacturers:

1. Haws Corporation.
2. Bradley Corp.
3. Guardian.
4. Speakman
5. Substitutions: Division 01 - General Requirements.

B. ANSI Z358.1; wall-mounted, self-cleaning, non-clogging eye and face wash with quick opening, full-flow valves, stainless steel eye and face wash receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings.

C. Provide thermostatic pressure balancing anti-scald mixing valve on inlet pipe with temperature gauge.

2.16 EMERGENCY SHOWERS

A. Emergency Shower Manufacturers:

1. Haws Corporation.
2. Bradley Corp.
3. Guardian.
4. Speakman
5. Substitutions: Division 01 - General Requirements.

B. ANSI Z358.1; wall-mounted, self- cleaning, non-clogging 8 inch diameter stainless steel deluge shower head with elbow, one inch full flow valve with pull chain and 8 inch diameter ring, one inch interconnecting fittings.

C. Provide (2) emergency shower test kits which include test curtain assembly.

D. Provide thermostatic pressure balancing anti-scald mixing valve on inlet pipe with temperature gauge.

2.17 EXPANSION TANKS

A. Manufacturers:

1. Amtrol.
2. Bell and Gossett.
3. Taco.
4. Watts.

B. Substitutions: Division 01 - General Requirements Construction: Welded steel, ASME labeled, tested and stamped in accordance with Section 8D of ASME Code; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

2.18 FIXTURE SUPPORTS

A. Manufacturers:

1. J.R. Smith.
2. Josam.
3. Wade.

4. Zurn.

5. MIFAB.

6. Substitutions: Division 01 - General Requirements.

B. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

C. For each wall-hung lavatory, urinal, water cooler, drinking fountain and water closet, provide concealed carrier suited for fixture, location, wall thickness and material.

D. Concealed carriers with exposed arms for sinks and lavatories shall have acid-resisting enamel finish.

2.19 FLOOR DRAINS

A. Manufacturers:

1. Josam.

2. J.R. Smith

3. Watts.

4. Wade.

5. Zurn

6. Substitutions: Division 01 - General Requirements.

B. ANSI A112.21.1, Round adjustable nickel-brass strainer, cast iron body, cast iron drainage flange, flashing clamp, and sediment bucket, provide with trap primer.

C. ANSI A112.21.1. Square, cast iron, drainage flange with weep holes, and internal cast iron dome strainer: Provide trap primer.

D. Drains shall have traps.

2.20 FLOOR SINK

A. Manufacturers:

1. Josam.

2. J.R. Smith.

3. Watts.

4. Zurn.

5. Wade

6. Substitutions: Division 01 - General Requirements.

B. ANSI A112.21.1. Square, cast iron, drainage flange with weep holes, and internal cast iron dome strainer: Provide trap primer.

C. Provide full, half, quarter grates, or less grate as required to suit job conditions.

2.21 TRENCH DRAINS

A. ASME A112.6.3; Trench drain system assembled from factory fabricated, polymer concrete castings in standard lengths and variable depths, with integral joint flanges and integral grating support rails; includes joint gaskets and grating.

2.22 HOSE BIBS

A. Manufacturers:

1. Woodford.

2. Josam.

3. Wade.

4. Zurn.

5. Watts.

6. Substitutions: Division 01 - General Requirements.

B. ANSI/ASSE 1011; Bronze or brass with integral mounting flange.

2.23 WALL/ROOF HYDRANTS

A. Manufacturers:

1. Woodford.

2. Josam.

3. Wade.

4. Zurn.

5. Watts.

6. Substitutions: Division 01 - General Requirements..

B. Wall Hydrant: ANSI/ASSE 1019; self-draining type, lead free, with removable key.

2.24 HOSE REEL

A. Manufacturers:

1. Chicago Faucet.

2. T&S Brass.

3. Substitutions: Division 01 - General Requirements.

B. Hose reel: ASME A112.18.1M

C. Accessories:

1. Hose reel assembly.

2. Serrated hose nozzle bleeder with flow control.

3. Self-closing spray valve.

4. Atmospheric vacuum breaker.

5. 35 ft rubber hose.

2.25 INDIRECT WASTE FUNNEL

A. Indirect waste funnel shall be:

1. For pipe 3" and smaller: J.R. Smith #3821.

B. Funnel shall have cast iron P-trap, cleanout, necessary adaptor for threaded outlet connection, trap primer and piping to prevent trap evaporation.

2.26 LAVATORY INSULATION KIT

A. Manufacturers:

1. McGuire

2. Truebro

3. Plumerex

4. Substitutions: Division 01 - General Requirements.

B. ANSI A177.1; Where Lavatories are noted to be insulated for ADA compliance, furnish safety covers consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

2.27 NEUTRALIZATION TANKS

A. Manufacturers:

1. Watts.

2. Orion

3. Zurn

4. Substitutions: Division 01 - General Requirements

B. ASTM D-4101; Polypropylene. Provide with heavy-duty Gamma top for easy access to tank.

2.28 OVERFLOW DRAINS

A. Manufacturers:

1. Josam.

2. J.R. Smith.

3. Watts.

4. Froet.

5. Wade.

6. Substitutions: Division 01 - General Requirements..

B. ANSI A112.21.2, cast iron body, flashing clamp, cast iron grate. Provide with standpipe interior to dome cover and extended to 2 inches above flood elevation.

2.29 PLUMBING TRAPS

A. Manufacturers:

1. McGuire Manufacturing Co.

2. Josam.

3. Wade.

4. Zurn.

5. Substitutions: Division 01 - General Requirements.

B. ASTM A888-20; Fixture traps shall be 17 gauge or heavier material; other traps shall be of same size and material as pipe on which trap occurs.

C. Provide cleanout for each trap. Running traps shall have double hubs for two cleanouts.

D. Provide deep traps with 4” minimum seal, for floor drains.

2.30 RECESSED VALVE BOXES

A. Manufacturers:

1. Woodford.
2. Josam.
3. Wade.
4. Zurn.
5. Watts.
6. Substitutions: Division 01 - General Requirements.

B. ASME A112.18.1;

C. Refrigerator: Plastic preformed rough-in box with brass water control valve.

D. Washing Machine: Plastic preformed rough-in box with brass water control valve, socket for 2 inch waste, and cover.

2.31 ROOF DRAINS

A. Manufacturers:

1. Josam.
2. JR Smith.
3. Watts.
4. Froet.
5. Wade.
6. Substitutions: Division 01 - General Requirements.

B. ANSI A112.21.2, adjustable, coated cast iron construction with large sump and flange, large cast iron dome, non-puncturing flashing clamp with integral gravel stop, underdeck clamp.

2.32 GREASE INTERCEPTOR

A. Manufacturers:

1. Watts.
2. Zurn.

3. Schier

4. Substitutions: Division 01 - General Requirements.

B. ASTM F2649-14; HDPE tanks.

2.33 TRAP PRIMERS

A. Manufacturers:

1. Woodford.

2. Josam.

3. Wade.

4. Zurn.

5. Watts.

6. PPP.

7. Substitutions: Division 01 - General Requirements.

B. ASSE 1018; Corrosion resistant brass, temperature range –40 to 450 degrees, ½" male inlet and ½" female outlet, pressure operating range 35 to 75 psig.

2.34 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Woodford.

2. Josam.

3. Wade.

4. Zurn.

5. Watts.

6. Substitutions: Division 01 - General Requirements.

B. ANSI A112.26.1; sized in accordance with PDI, precharged, suitable for operation in temperature range -100 to 300 degrees F (-73 to 149 degrees C) and maximum 250

2.35 STOPS

A. Manufacturers:

1. Brass Craft.

2. Watts.

3. Nibco.

4. McGuire.

5. Substitutions: Division 01 - General Requirements.

B. ASME A112.18.1;

C. Chrome plated angle brass supply stop valve with full turn brass stem, lead free, inlet shall be 1/2-inch sweat, outlet shall be 3/8-inch compression.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - General Requirements

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

B. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

3.3 INSTALLATION

A. Install Work in accordance with State of Florida standards.

B. Install in accordance with manufacturer’s instructions.

C. Install each fixture with trap, easily removable for servicing and cleaning.

D. Provide chrome plated rigid supplies to fixtures with screwdriver stops, reducers, and escutcheons.

E. Install components level and plumb.

F. Install and secure fixtures in place with wall carriers and bolts.

G. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 92 00, color to match fixture.

H. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

I. For ADA accessible water closets, install flush valve with handle to wide side of stall.

J. Refer to architectural drawing for required mounting heights of fixtures.

K. Install in accordance with manufacturer's instructions.

L. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

M. Cleanouts shall be same size as the pipes served, up to 4 inches; 5 and 6 inch pipes shall have 4 inch cleanouts; 8 inch pipes shall have 6 inch cleanouts; 10 inch pipes and larger shall have 8 inch cleanouts.

N. Install components level and plumb.

O. Install water hammer arrestors with isolation valve in accessible locations.

P. Trap primers shall be installed to serve all floor drains, provide distribution units as required for all drains.

Q. Provide 1/2 grate cover on all floor sinks as required for discharge pipe into floor sink, cut inlet pipe on 45 degree angle.

R. Trap primer connections shall be installed on cold water piping 1 ½ inch diameter or less.

3.4 INTERCEPTORS

A. Provide sediment interceptors for all art room sinks, maintain clearances as required by the manufacturer.

B. Provide grease interceptor to intercept all drainage from kitchen drains, installation shall conform to all State of Florida Health Department requirements.

3.5 NEUTRALIZATION TANKS

A. Provide acid neutralization tank to serve all science classroom sinks, maintain clearances as required by the manufacturer.

B. Provide pipe connections and venting requirements as required by the tank manufacturer.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.7 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.8 CLEANING

A. Division 01 - General Requirements: Product Requirements: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Division 01 - General Requirements: Product Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

3.10 COMMISSIONING OF EQUIPMENT

A. Engage a factory-authorized service representative, who is familiar with this project, to participate and assist, if necessary, in the functional performance testing of this equipment with the Commissioning Agent.

END OF SECTION

SECTION 230400 - GENERAL CONDITIONS FOR MECHANICAL TRADES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to all Divisions 23 Sections.

B. This section applies to certain sections of Division 26, "Electrical," and this section applies to all sections of Division 23, "Mechanical" of this project specification unless specified otherwise in the individual sections.

C. The Drawings of other trades (Architectural, Food Service, Structural, Landscape, Civil, Mechanical, Fire Protection and Plumbing) shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

1.2 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division. Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

1.3 INTENT

A. It is the intent of the Specifications and Drawings to call for finished work, tested and ready for operation. Provide all parts necessary for the intended use, fully complete and operational, and installed in professional manner in accordance with the design intent.

B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and ready for operation as determined by good trade practice even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.

C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section includes the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

1.4 DEFINITIONS

A. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

B. “Approved equal” mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

D. “Finished” refers to all rooms and areas to be specified to receive architectural treatment as indicated on the drawings. All rooms and areas not covered, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

E. “Furnish” or “supply” shall mean purchase, deliver to, and off-load at the job site, ready to be installed including where appropriate all necessary interim storage and protection.

F. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

G. “Install” shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.

H. “Product” shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

I. “Provide” shall mean furnish (or supply) and install as necessary.

J. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

K. Remove: The term “remove” means “to disconnect from its present position, remove from the premises and to dispose of in a legal manner.”

L. Special Warranties: The term “Special Warranties” are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

M. Standard Product Warranties: The term “Standard Product Warranties” are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

N. “Subcontractor” means specifically the subcontractor working under this Division. Other Contractors are specifically designated “Plumbing Subcontractor”, “General Contractor” and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.

O. Substitutions: Requests for changes in products, materials, equipment, and methods of construction proposed by the Contractor are considered requests for "substitutions."

P. “Wiring” shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

1.5 CONTRACT DOCUMENTS

A. The two dimensional drawings govern the construction. They show the design intent and are part of the Contract Documents. BIM models are not part of contract documents. They are developed for convenience only.

B. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)

C. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.

D. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

1.6 DISCREPANCIES IN DOCUMENTS

A. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.

B. Where Drawings or Specifications conflict or are unclear, submit clarification request in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or un-clarities thus resolved.

C. Where Drawings or Specifications do not coincide with manufacturers' recommendations or with applicable codes and standards, submit clarification request in form of an RFI before installation. Otherwise, make changes in installed work required for compliance with manufacturer instructions or codes and standards within Contract Price.

D. Where insufficient information exists in the documents to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building elements, where notification required by Paragraph (B) above has not been submitted, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in professional manner either concealed or exposed in accordance with the design intent.

E. Where discrepancies exist between the mechanical, plumbing, fire protection, and electrical drawings in regards to what trade owns disconnects or starters, the discrepancy shall be brought to the Architect's attention in accordance with paragraph (B) above. If the scope is not resolved prior to the Award of Contract, Division 26 shall provide such items.

1.7 CODES AND STANDARDS

A. Reference Standard Compliance

1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

2. Independent Testing Organization Certificate: In lieu of the label or listing indicated above, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. Wherever Codes and/or Standards are mentioned in these Specifications, the latest applicable edition or revision of the local building or life safety code shall be followed.

C. The following Standards shall be used where referenced by the following abbreviations:

AABC	Associated Air Balance Council
ACGIH	American Conference of Governmental Industrial Hygienists
ADC	Air Diffusion Council
AGA	American Gas Association
AIA	American Institute of Architects
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute

ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society of Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CGA	Compressed Gas Association
CSA	Canadian Standards Association
CISPI	Cast Iron Soil Pipe Institute
EJMA	Expansion Joint Manufacturing Association
EPA	Environmental Protection Agency
FM	Factory Mutual
FSSC	Federal Specification
HIS	Hydraulic Institute Standards
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
ISO	Insurance Services Office
MCAA	Mechanical Contractors Association of America
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NOFI	National Oil Fuel Institute
NSC	National Safety Council
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PDI	Plumbing and Drainage Institute
SBI	Steel Boiler Industry (Division of Hydronics Institute)

SMACNA	Sheet Metal and Air Conditioning Contractors National Association
STI	Steel Tank Institute
UL	Underwriters' Laboratories

D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.8 PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the work, file all necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.9 EQUIPMENT EQUIVALENTS AND SUBSTITUTIONS

A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of quality, finish and design that is required. If the Contractors uses an "approved equal" alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.

B. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.

C. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.

D. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non approved equivalent to that specified and the amount of

credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer's equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

E. If an alternative or substitute item results in a difference in quantity and arrangement of structure, piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.

F. Equipment, material or devices submitted for review as a "substitution" shall meet the following requirements:

G. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.

H. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.

b. Samples, where applicable or requested.

c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.

e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

f. Cost information, including a proposal of the net change, if any in the Contract Sum.

g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional

payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.

i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.

2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.10 SUBMITTAL PROCEDURES

A. Provide Submittals in accordance with the requirements of Division 1 and as indicated in the following.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

1. Allow ten business days for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.

2. If an intermediate submittal is necessary, process the same as the initial submittal.

3. Allow ten business days for reprocessing each submittal.

4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block. Submittals shall be arranged in order of specification sections.

1. Include the following information on the label for processing and recording action taken.

a. Project name.

b. Date.

c. Name and address of Engineer.

d. Name and address of Contractor.

e. Name and address of subcontractor.

f. Name and address of supplier.

g. Name of manufacturer.

h. Number, title and paragraph of appropriate Specification Section.

i. Drawing number and detail references, as appropriate.

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

F. Except for submittals for record, information or similar purposes, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.

G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.

1.11 SHOP DRAWINGS

A. Submit neatly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated ductwork layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review all shop drawings to be incorporated in the Mechanical Contract.

C. Provide shop drawings for all devices specified under equipment specifications for all systems. Shop drawings shall include manufacturers' names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures), of all shop drawings, catalog cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.

D. When a submittal could involve more than one trade, e.g., valves, piping, etc., the submitted shall be separated by traded involved, ie. HVAC, plumbing, fire protection, etc.

E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.

F. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

G. "No Exception Taken" rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings. Review of shop drawings shall not apply to quantity of material.

H. After shop drawings have been reviewed, with no exceptions taken, no further changes will be allowed without the written consent of the Engineer.

I. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

J. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to Bidding to allow for issuance of an Addendum.

K. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

L. All submittals shall be made in electronic PDF format with searchable OCR (Optical Character Recognition) format. This excludes scanned and faxed materials.

1.12 COORDINATION DRAWINGS AND BIM MODEL

A. Coordination drawings are required for all mechanical and electrical trades. The content and procedures described in Division 01 shall be followed, with the additional requirements specifically for the mechanical and electrical trades as described in this Section. If a BIM model is not used on this project, the below requirements shall be accomplished in CAD.

B. Prepare coordination drawings accordance with Division 1, at 1 to 1 (full) scale prepared at ¼" = 1' -0" 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. The Contractor shall indicate the proposed locations of piping, conduit, ductwork, equipment, and materials. Include the following:

a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

b. Equipment connections and support details.

c. Exterior wall and foundation penetrations.

d. Fire-rated wall and floor penetrations.

e. Sizes and locations of required concrete pads and bases.

C. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

D. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

E. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

F. The Contractor and each subcontractor shall sign and date each coordination drawing prior to submission.

G. Work shall not be performed until coordination drawings have been approved by the architect and engineer.

H. Electronic copies of the MEP floor plans and/or BIM model are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. If the Contractor elects to obtain the Engineers electronic files an Electronic Drawing File Release Form must be submitted. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic Drawing File Release Form, the Engineer will provide copies of the electronic files for the Contractor's use. A copy of the Electronic Drawing File Release Form is appended to the end of this specification section

I. Review by Engineer of coordination drawings is limited to confirming that requirements for coordination and preparation of plans have been complied with by the Contractor and shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other related work.

1.13 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, HVAC piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

E. The two dimensional drawings are diagrammatic. They indicate general arrangements of mechanical systems and other work, and are intended to convey sufficient information for skilled contractors and tradespeople to furnish and install complete systems. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based

on the systems concept, the main components, and the approximate geometrical relationships, provide all other components and materials to make the systems fully complete, coordinated with other systems and the structure and space available, and operational. Similarly, the drawings do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades in order to avoid interferences and to meet ceiling heights and other Architectural requirements. Establish and provide offsets, changes in direction, and exact routings to coordinate all systems. Where conflicts or potential conflicts exist and engineering guidance is desired, submit a “Request for Information” (RFI).

F. Controls contractor shall coordinate and sequences of operation with all other trades as necessary to provide a complete and functioning system.

1.14 QUALITY CONTROL

A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled tradespeople, fitters, metal workers, welders, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

E. All labor for installation of mechanical systems shall be performed by experienced, skilled tradespeople under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, professional manner. The Engineer reserves the right to reject any work which, in their opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.15 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner.

B. The Engineer and the Owner shall be notified in writing of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.16 TEMPORARY UTILITIES

A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

C. First Aid Supplies: Comply with governing regulations.

D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

E. Utilities: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.

1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.

F. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

G. Temporary Heat-Cool-Dehumidification: Provide temporary services required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate temporary services to produce the ambient condition required and minimize consumption of energy. The building’s permanent HVAC systems shall not be used for these purposes.

H. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

I. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.17 Equipment Access

A. Appliances, controls devices, heat exchangers and HVAC system components that utilize energy shall be accessible for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, venting systems or any other piping or ducts not connected to the *appliance* being inspected, serviced, repaired or replaced. A level working space not less than 30 inches deep and 30 inches wide (762 mm by 762 mm) shall be provided in front of the control side to service an *appliance*.

1.18 BUILDING FLUSH-OUT

A. Building flush-out shall begin after construction ends and finishes are installed but prior to building occupancy. Prior to building flush-out, HVAC systems shall be balanced per Specification Section 23 05 93. Flush-out shall not occur until contractor receives permission to proceed from the Owner or Owner's representative..

B. Building flush-out procedures shall include continuously operating all the building's new ventilation systems at maximum design outside air flow rates. For constant volume HVAC systems, ventilation systems shall operate at maximum design supply air flow rates.

1.19 PROJECT PHASING

A. Work under each Section shall include all necessary temporary connections, equipment, piping, heating, temperature control work, fire stopping, water heaters, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required to maintain existing systems operational or to accommodate the construction phasing of the project.

1.20 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or workpeople and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open

ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by tradespeople or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.21 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer's recommendations and is operating as intended by the manufacturer.

1.22 CLEANING

A. The Contractor shall thoroughly clean and flush all piping, ducts and equipment of all foreign substances, oils, burrs, solder, flux, etc., inside and out before being placed in operation.

B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. During the course of construction, all ducts and pipes shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work. Any oil or grease stains on floor areas caused by the Contractor shall be removed and floor areas left clean.

E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Remove labels that are not permanent labels.

2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

4. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material, skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.

G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

1.23 OPERATING AND MAINTENANCE

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, the contractor shall fully instruct the Owner or the Owner’s representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) days notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.

C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

D. An authorized manufacturer’s representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. The following equipment will require this inspection: pumps; air conditioning equipment, controls, air handling equipment, compressors, boilers etc. These letters shall be bound into the operating and maintenance books.

E. Refer to individual trade Sections for any other particular requirements related to operating instructions.

F. Demonstration shall be recorded on USB Flash drive turned over to the Owner. Video recording shall be done in a professional manner with quality video (1080p resolution) and clear audible sound.

1.24 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with the requirements of Division 1 and as follows. The Contractor shall prepare up to six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-ring vinyl-covered binders, with pocket folders for folded sheet information and designation partitions with identification tabs. Mark appropriate identification on front and spine of each binder.

B. Manual shall include the following:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing and operating instructions including lubrication charts and schedules.

5. Emergency and safety instructions.

6. Spare parts list.

7. Copies of warranties.

8. Wiring diagrams.

9. Recommended "turn around" cycles.

10. Inspection procedures.

11. Approved Shop Drawings and Product Data.

12. Equipment Start-up Reports.

13. Temperature control diagrams and written sequences of operations.

14. Balance reports.

C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, filter quantities and sizes, bearing number, etc. Schedule shall include maintenance to be done and frequency.

D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.

1.25 ACCEPTANCES

A. The equipment, materials, quality, design and arrangement of all work installed under the Mechanical Sections shall be subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, the Mechanical Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Mechanical Sections. The intent to use the exact manufacturers and models specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of award of the Contract. In such instances, equipment substitutions may be made pending acceptance by the Engineer or the Owner's representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Mechanical Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.26 RECORD DRAWINGS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Items to be indicated include but are not limited to:

1. Dimensional change

2. Revision to drawing detail

3. Location and depth of underground utility

4. Revision to pipe routing

5. Revision to electrical circuitry

6. Actual equipment location

7. Duct size and routing

8. Location of concealed internal utility

9. Changes made by Change Order

10. Details not on original Contract Drawing

11. Information on concealed elements which would be difficult to identify or measure later

C. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

D. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

E. Note related Change Order numbers where applicable.

F. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

G. Final record documents shall be prepared in the latest electronic version and on USB Flash drive of all drawings and a clean set of reproducible paper copies shall be turned over to the Owner at the completion of the work.

1.27 WARRANTIES AND BONDS

A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties are to be included:

1. General close-out requirements included in Division 1.

2. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions-2 through -50.

3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.28 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.

1. Refer to individual Sections of Divisions-2 through -50 for specific content requirements, and particular requirements for submittal of special warranties.

J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.

3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.29 GUARANTEES

A. The Contractor shall guarantee all material and installation quality under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner. During this guarantee period, all defects developing through faulty equipment, materials or installation quality shall be corrected or replaced immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineer's satisfaction.

B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided.

1.30 PROJECT CLOSE-OUT

A. Submit specific warranties, quality bonds, maintenance agreements, final certifications and similar documents in accordance with Division 1.

B. Deliver tools, spare parts, extra stock, and similar items.

C. Complete start-up testing of systems, including measuring and documenting all required startup checklist requirements documented in installation and maintenance instructions by the equipment manufacturer, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

D. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

E. Field Observation Procedures: On receipt of a request for an Engineers Field Observation, the Engineer will advise the Contractor of unfulfilled requirements. The Engineer will advise the Contractor of construction that must be completed or corrected before the certificate will be issued. Contractor shall submit written response to each corrective item including specific photos prior to final Engineering inspection.

1. The Engineer will repeat the Field Observation when requested and assured that the Work has been substantially completed.

2. Results of the completed list of unfulfilled items will form the basis of requirements for final acceptance.

END OF SECTION

Electronic Drawing File Release Form

DELIVERY OF FILES FOR: _____

Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Client covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Client further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys' fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____ _____

Client's Signature Date

_____

Company - Title

_____ _____

Architects' Signature Date

_____

Firm - Title

_____ _____

Owner's Signature Date

_____

Company - Title

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.2 RELATED REQUIREMENTS

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

B. Division 07 – Thermal and Moisture Protection.

C. Division 09 - Finishes.

D. Section 23 0553 - Identification for HVAC Piping and Equipment: Piping identification.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

1.4 SUBMITTALS

A. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Valve Stem Packings: Two for each type and size of valve.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified this section.
1. Minimum three years experience.
2. Approved by manufacturer.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.7 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Materials
   1. Galvanized-Steel Sheet: 0.0239-inch 0.6-mm minimum thickness; round tube closed with longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.2 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. Flexicraft Industries; PipeSeal.
   2. Metraflex
   3. Link-Seal
   4. Substitutions: See Division - 01 General Requirements.

B. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.
   3. Elastomer element size and material in accordance with manufacturer's recommendations.
   4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.1 GENERAL

A. Lay out penetration and sleeve openings in advance, to permit provision in work. Coordinate work with architectural and structural work. Set sleeves and conduit in forms before concrete is poured. Provide remedial work where sleeves and conduits are omitted or improperly placed. Remedial work includes core drilling (see requirements below) for penetrations if walls are poured, or otherwise constructed, without required sleeves. Provide core drilling (see requirements below) of existing construction. Do not penetrate structural members without Structural Engineer’s/Architect's written approval.

B. Sleeve installation shall meet NFPA-101 requirements, UL rated assemblies requirements, and materials requirements of these specifications. Submit a list of the UL listed details that the Contractor intends on using on this project in all rated assemblies.

C. Sleeves that penetrate outside walls, basement slabs, footings and beams shall be waterproof. Sleeves that penetrate floors shall be fireproof and waterproof.

D. Identify unused sleeves and slots for future installation. Fill slots, sleeves and other openings in floors or walls if not used. Fill spaces in openings after installation of pipe, duct, conduit or cable. Fill for floor penetrations shall prevent passage of water, smoke, fire, and fumes. Fill shall be fire resistant in fire floors and walls, and shall prevent passage of air, smoke and fumes.

E. Do not support piping risers or conduit on sleeves.

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 for materials.

G. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements. Verify final equipment locations for roughing-in.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.3 APPLICATIONS

A. Provide sleeves when penetrating footings, floors, walls, partitions, and other building components as follows:
   1. Interior walls, partitions, and floors: galvanized-steel sheet, unless steel or brass sleeves are specified elsewhere.
   2. Below Grade Exterior Walls: Zinc coated or cast iron pipe with mechanical sleeve seals. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
   3. Above Grade Exterior Walls: steel pipe sleeve with mechanical sleeve seals.
   4. Mechanical, Laundry, and Animal Room Floors above Basement: Galvanized steel pipe or black iron pipe with asphalt coating. Connect sleeve with floor plate except in mechanical rooms.
   5. Concrete and masonry walls, concrete floor and roof slabs: galvanized-steel sheet
   6. Floors with membrane waterproofing: stack sleeve fittings

3.4 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Install sleeves that are large enough to provide 1/4 inch annular clear space between sleeve and pipe or pipe insulation. Sleeves for insulated pipe and duct in non-fire rated construction shall accommodate continuous insulation without compression. Sleeves and/or penetrations in fire rated construction shall be packed with fire rated material that shall maintain the fire rating of the wall. Seal ends of penetrations to provide continuous vapor barrier where insulation is interrupted.

E. Where pipes passing through openings are exposed in finished rooms, finishes of filling materials shall match and be flush with adjoining floor, ceiling, and wall finishes.

F. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

G. Structural Considerations:
1. Do not penetrate building structural members unless indicated.

H. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Underground Piping: Mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
   a. Pack solid using mineral fiber conforming to ASTM C592.
   b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
3. All Rated Openings: Caulk tight with fire stopping material conforming to ASTM E814 in accordance with Division 07 to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight with Mechanically expandable chloroprene inserts with mastic-sealed components.

I. Vertical Piping:
1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

J. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814 in accordance with Division 07 to prevent the spread of fire, smoke, and gases.

K. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.

L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.5 CORE DRILLING

A. Core drilling shall be avoided in new construction. Set sleeves prior to installation of structure for passage of pipes, conduit and ducts. Where core drilling is unavoidable (e.g. when individual sleeves are not installed or incorrectly located) or required by renovation projects, locate required openings prior to coring and submit locations for review.

B. Coordinate openings with other Divisions.

C. Do not disturb existing systems. Protect areas from damage.

D. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.

3.6 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe hangers and supports.

B. Duct hangers and supports

C. Hanger rods.

D. Inserts.

E. Flashing.

F. Formed steel channel.

G. Equipment bases and supports.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B31.1 - Power Piping.
   2. ASME B31.5 - Refrigeration Piping.
   3. ASME B31.9 - Building Services Piping.

B. ASTM International:
   1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   2. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
   3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
   4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:
   1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.4 PERFORMANCE REQUIREMENTS

A. Contractor shall design supports for multiple pipes and/or ducts, including pipe and duct stands, capable of supporting combined weight of supported systems, system contents, and fluid.

B. Contractor shall design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

B. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

C. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Welding certificates.

E. Manufacturer's Installation Instructions:
1. Hangers and Supports: Submit special procedures and assembly of components.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." and AWS D1.3, "Structural Welding Code--Sheet Steel."

B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum 3 years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following::
1. B-Line Systems, Inc.
2. National Pipe Hanger Corporation
3. Empire Industries, Inc.
4. Globe Pipe Hanger Products Inc.
5. Michigan Hanger Co.
6. PHD Manufacturing, Inc.
7.

C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 DUCT HANGERS AND SUPPORTS

A. Shall be in accordance with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" except non-engineered wire hangers are not permitted. Engineered cable support systems may be used if they meet SMACNA, Ductmate or approved equal.

B. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

C. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

D. Strap and Rod Sizes: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct.

E. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

F. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

G. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

H. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

I. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate

2.3 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.4 THERMAL SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield. Insert shall be capable of supporting weight of pipe, insulations and fluid without crushing.

B. Manufacturers:
1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or 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.

B. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Empire Industries, Inc.
3. Hilti, Inc.
4. ITW Ramset/Red Head.
5. MKT Fastening, LLC.
6. Powers Fasteners.

2.6 MISCELLANEOUS MATERIALS

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

B. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

C. Equipment Supports: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

D. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Midland Ross Corporation, Electrical Products Division
4. Unistrut Corp.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 EXECUTION

3.1 PIPE HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in other Division 23 Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system specific sections, install the following types:

1. MSS Type 1 - Adjustable, Steel Clevis Hangers: For suspension of non-insulated or insulated stationary pipes, 2 inch to 30 inch size.
2. MSS Type 2 - Yoke-Type Pipe Clamps: For suspension of 120 to 450 deg F pipes, 4 inch to 16 inch size, requiring up to 4 inches of insulation.
3. MSS Type 3 - Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps: For suspension of pipes, 3/4 inch to 24 inch size, requiring clamp flexibility and up to 4 inches of insulation.
4. MSS Type 4 - Steel Pipe Clamps: For suspension of cold and hot pipes, 1/2 inch to 24 inch size, if little or no insulation is required.
5. MSS Type 5 - Pipe Hangers: For suspension of pipes, 1/2 inch to 4 inch size, to allow off-center closure for hanger installation before pipe erection.
6. MSS Type 12 - Extension Hinged or 2-Bolt Split Pipe Clamps: For suspension of non-insulated stationary pipes, 3/8 inch to 3 inch size.
7. MSS Type 24 - U-Bolts: For support of heavy pipes, 1/2 inch to 30 inch.
8. MSS Type 26 - Clips: For support of insulated pipes not subject to expansion or contraction.
9. MSS Type 36 - Pipe Saddle Supports: For support of pipes, 4 inch to 36 inch size, with steel pipe base stanchion support and cast-iron floor flange.
10. MSS Type 37 - Pipe Stanchion Saddles: For support of pipes, 4 inch to 36 inch size, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
11. MSS Type 38 - Adjustable, Pipe Saddle Supports: For stanchion-type support for pipes, 2-1/2 inch to 36 inch size, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
12. MSS Type 41 - Single Pipe Rolls: For suspension of pipes, 1 inch to 30 inch size, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
13. MSS Type 43 - Adjustable Roller Hangers: For suspension of pipes, 2-1/2 inch to 20 inch size, from single rod if horizontal movement caused by expansion and contraction might occur.

14. MSS Type 44 - Complete Pipe Rolls: For support of pipes, 2 inch to 42 inch size, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
15. MSS Type 45 - Pipe Roll and Plate Units: For support of pipes, 2 inch to 24 inch, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
16. MSS Type 46 - Adjustable Pipe Roll and Base Units: For support of pipes, 2 inch to 30 inch size, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 8 - Extension Pipe or Riser Clamps: For support of pipe risers, ¾ inch to 20 inch size.
2. MSS Type 42 - Carbon- or Alloy-Steel Riser Clamps: For support of pipe risers, 3/4 inch to 20 inch size, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 13 - Steel Turnbuckles: For adjustment up to 6 inches for heavy loads.
2. MSS Type 14 - Steel Clevises: For 120 to 450 deg F piping installations.
3. MSS Type 15 - Swivel Turnbuckles: For use with MSS Type 11, split pipe rings.
4. MSS Type 16 - Malleable-Iron Sockets: For attaching hanger rods to various types of building attachments.
5. MSS Type 17 - Steel Weldless Eye Nuts: For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 18 - Steel or Malleable Concrete Inserts: For upper attachment to suspend pipe hangers from concrete ceiling.
2. MSS Type 19 - Top-Beam C-Clamps: For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. MSS Type 20 - Side-Beam or Channel Clamps: For attaching to bottom flange of beams, channels, or angles.
4. MSS Type 21 - Center-Beam Clamps: For attaching to center of bottom flange of beams.
5. MSS Type 22 - Welded Beam Attachments: For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. MSS Type 23 - C-Clamps: For structural shapes.
7. MSS Type 25 - Top-Beam Clamps: For top of beams if hanger rod is required tangent to flange edge.
8. MSS Type 27 - Side-Beam Clamps: For bottom of steel I-beams.
9. MSS Type 28 - Steel-Beam Clamps with Eye Nuts: For attaching to bottom of steel I-beams for heavy loads.
10. MSS Type 29 - Linked-Steel Clamps with Eye Nuts: For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. MSS Type 30 - Malleable Beam Clamps with Extension Pieces: For attaching to structural steel.

12. 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.
13. MSS Type 34 - Side-Beam Brackets: For sides of steel or wooden beams.
14. MSS Type 57 - Plate Lugs: For attaching to steel beams if flexibility at beam is required.
15. MSS Type 58 - Horizontal Travelers: For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 39 - Steel Pipe-Covering Protection Saddles: To fill interior voids with insulation that matches adjoining insulation.
2. MSS Type 40 - Protection Shields: Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 47 - Restraint-Control Devices: Where indicated to control piping movement.
2. MSS Type 48 - Spring Cushions: For light loads if vertical movement does not exceed 1-1/4 inches.
3. MSS Type 49 - Spring-Cushion Roll Hangers: For equipping Type 41 roll hanger with springs.
4. MSS Type 50 - Spring Sway Braces: To retard sway, shock, vibration, or thermal expansion in piping systems.
5. MSS Type 51 - Variable-Spring Hangers: Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. MSS Type 52 - Variable-Spring Base Supports: Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. MSS Type 53 - Variable-Spring Trapeze Hangers: Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

3.2 PIPE 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.
1. 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.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System for Multiple Hangers: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
3. Floor Support: concrete pier or steel support.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:
1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

N. Design hangers for pipe movement without disengagement of supported pipe.

O. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 23 07 00 Provide supplemental angles, channels and formed steel supports to support piping, ductwork, equipment, etc. from building's structure. Piping, ductwork, equipment, etc. shall not be supported from the roof deck.

3.3 DUCT HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5- 2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports to suspend equipment from structure overhead or to support equipment above floor. Fabricate supports from welded-structural steel shapes. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 21 05 48.

3.5 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.

3.6 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.7 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE HANGER ROD DIAMETER Inches
1/2	5	7	3/8	3/8
3/4	5	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	7	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2 (Note 2)	9	11	1/2	1/2
3	10	12	1/2	1/2
4	12	14	1/2	5/8
5	13	16	1/2	5/8
6	14	17	5/8	3/4
8	16	19	3/4	3/4
10	18	22	3/4	7/8
12	19	23	3/4	7/8
14	22	25	7/8	1
16	23	27	7/8	1
18	25	28	1	1
20	27	30	1	1-1/4
24	28	32	1-1/4	1-1/4

B. Plastic and Ductile Iron Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
ABS (All sizes)	4	3/8
FRP (All Sizes)	4	3/8
Ductile Iron (Note 2)		
PVC (All Sizes)	4	3/8

C. Note 1: Refer to manufacturer's recommendations for grooved end piping systems.

D. Note 2: 20 feet maximum spacing, minimum of one hanger for each pipe section close to joint behind bell. Provide hanger at each change of direction and each branch connection. For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents, limit span to maximum spacing for water service steel pipe.

END OF SECTION

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment support bases.

B. Vibration isolators, non-seismic type

C. Roof curbs.

1.2 RELATED REQUIREMENTS

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

B. Division 03 - Concrete.

C. Section 23 0400 – General Conditions for Mechanical Trades.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. Air Movement and Control Association International, Inc.:
1. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

B. American National Standards Institute:
1. ANSI S1.4 - Sound Level Meters.
2. ANSI S1.8 - Reference Quantities for Acoustical Levels.
3. ANSI S1.13 - Methods for the Measurement of Sound Pressure Levels in Air.
4. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.

C. Air-Conditioning and Refrigeration Institute:
1. ARI 575 - Method of Measuring Machinery Sound within Equipment Space.

D. American Society of Heating, Refrigerating and Air Conditioning:
1. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
2. ASHRAE Handbook - HVAC Applications.

E. ASTM International:
1. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
2. ASTM E477 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
3. ASTM E596 - Standard Test Method for Laboratory Measurement of the Noise Reduction of Sound-Isolating Enclosures.

F. Sheet Metal and Air Conditioning Contractors' National Association:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

G. American Society of Civil Engineers
1. ASCE - Minimum Design Loads for Buildings and Other Structures.

1.4 INTENT

A. All mechanical equipment, piping and ductwork as noted on the equipment schedule or in the specification shall be mounted on or suspended from vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.

B. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.

C. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.

1.5 SUBMITTALS

A. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products. Shop Drawings:
1. Provide schedule of vibration isolator type with location and load on each.
2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.
3. Include auxiliary motor slide bases and rails, base weights, inertia bases, concrete weights, equipment static loads, support points, vibration isolators, and detailed layout of isolator location and orientation with static and dynamic load on each isolator.
4. Include selections from prescriptive design tables that indicate compliance with the applicable building code and the vibration isolator manufacturer's requirements.
Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.

B. Delegated-Design Submittal:
1. For each vibration isolation device.
a. Include design calculations and details for selecting vibration isolators, vibration isolation bases, and appropriate attachment methods for all equipment.
b. Design Calculations: Calculate static and dynamic loading due to equipment weight and required to select vibration isolators and for designing vibration isolation bases.
1) Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
c. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure and spring deflection changes. Include

certification that riser system was examined for excessive stress and that none exists.

2. Mechanical equipment, appliances, ductwork, and supports that are exposed to wind shall be designed to resist the wind pressures determined in accordance with the International Building Code.
   a. Design Calculations: Calculate loading due to wind pressure and required to select vibration isolators and for designing vibration isolation bases.
   b. Include the seal of the Professional Structural Engineer registered where the Project is located, on the drawings and calculations.

C. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.6 QUALITY ASSURANCE

A. Perform design and installation in accordance with applicable codes.

B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and registered and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
   1. Member of Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

D. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Mason Industries.

B. Kinetics Noise Control, Inc.

C. Vibration Eliminator Company, Inc.

2.2 VIBRATION ISOLATORS, NON-SEISMIC TYPE

A. Elastomeric Pads:
   1. Material: Oil, ozone, and oxidant resistant rubber, neoprene or other elastomeric compounds.

2. Thickness: 0.25 inch minimum.
3. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with load plate providing evenly distributed load over pad surface.
4. Surface Pattern: Smooth, ribbed or waffle pattern.

B. Elastomeric Mounts:
1. Material: Oil, ozone, and oxidant resistant rubber, neoprene or other elastomeric compounds.
2. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.

C. Open Steel Springs:
1. Assembly: Freestanding, laterally stable without housing.
2. Outside spring
3. Leveling Device: Rigidly connected to equipment or frame.

D. Restrained Steel Springs:
1. Housing: Rigid blocking during rigging prevents equipment installed and operating height from changing during temporary weight reduction.
2. Equipment Wind Loading: Adequate means for fastening isolator top to equipment and isolator base plate to supporting structure.

E. Elastomeric Hangers:
1. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
2. Incorporate steel load distribution plate sandwiching elastomeric element to housing.

F. Spring Hanger:
1. Description: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact. Mountings shall have leveling bolts that shall be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load.
2. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
3. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

G. Combination Elastomeric-Spring Hanger:
1. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
2. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

H. Thrust Restraints:
1. Housing: Steel construction containing stable steel spring and integral elastomeric element installed in pairs to resist air pressure thrusts.
2. Bottom Openings: Sized to allow plus/minus 15 degrees rod misalignment.

2.3 EQUIPMENT SUPPORT BASES

A. Spring Isolated Steel Rails:

1. Construction: Engineered, structural steel frames with welded brackets for side mounting of the isolators. Roof Rails shall be flashed and waterproofed into the roof's membrane waterproofing system.
2. Frames: Square, rectangular or T-shaped.
3. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
4. Applications: Adjustable motor slide rails for centrifugal fans.

B. Concrete Inertia Bases:
1. Construction: Engineered, steel forms, with integrated isolator brackets and anchor bolts, welded or tied reinforcing bars running both ways in a single layer.
2. Size: 6 inches minimum depth and sized to accommodate elbow supports.
3. Mass: Minimum of 1.5 times weight of isolated equipment.
4. Connecting Point: Reinforced to connect isolators and snubbers to base including template and fastening devices for equipment.
5. Concrete: Filled on site with minimum 3000 psi concrete. See Section 03 3000 for additional requirements.
6. Applications: Adjustable motor slide rails for centrifugal fans.

2.4 ROOF CURBS

A. Vibration Isolation Curbs:
1. Non-Seismic Curb:
a. Location: Between structure and rooftop equipment.
b. Construction: Aluminum.
c. Integral vibration isolation to conform to requirements of this section.
d. Weather exposed components consist of corrosion resistant materials.
e. All curb attachments shall be designed to withstand hurricane force winds in accordance with the Florida Building Code, current edition.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Bases:
1. Set steel bases for one inch clearance between housekeeping pad and base.
2. Set concrete inertia bases for 2 inches clearance between housekeeping pad and base.
3. Adjust equipment level.

C. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

D. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

E. Provide pairs of horizontal limit springs on fans with more than 6.0 inches WC static pressure, and on hanger supported, horizontally mounted axial fans.

F. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance.
   1. Up to 4 Inches Pipe Size: First three points of support.
   2. 5 to 8 Inches Pipe Size: First four points of support.
   3. 10 inches Pipe Size and Over: First six points of support.
   4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

G. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.

H. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.

I. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

J. The contractor shall not install any equipment, piping, duct or conduit that makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls. Any conflicts with other trades that will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor’s expense.

K. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractor’s expense.

L. Cast in place inserts or wedge type drill-in concrete anchors. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.

M. Steel springs to operate in the linear portion of the load versus deflection curve over deflection range of not less than 50 percent above specified deflection.

N. Lateral to vertical stiffness ratio to not exceed 0.08 with spring deflection at minimum 75 percent of specified deflection.

O. All equipment mounted on vibration isolated bases to have minimum operating clearance of 2 inches between the base and floor or support beneath unless noted otherwise.

3.2 INSTALLATION OF CONCRETE INERTIA BASES

A. Minimum operating clearance between concrete inertia and base and housekeeping pad or floor shall be 2”.

B. The equipment structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the machine or isolators.

C. The isolators shall be installed without raising the machine and frame assembly.

D. After the installation is complete and under full load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. When all isolators are properly adjusted, the blocks or shims shall be removed.

E. Verify that all installed isolator and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 1/4".

F. Prior to start-up, clean out all foreign matter between bases and equipment. Verify that there are no isolation short circuits in the base, isolators, or seismic restraints.

3.3 PIPING SYSTEM VIBRATION ISOLATION

A. Vibration isolators for suspended piping:
   1. Provide spring hangers for all piping in equipment rooms and up to 50 ft from vibration-isolated equipment and PRV stations. The first three hangers from the equipment shall be provided with the same deflection as the equipment isolators, with a maximum limitation of 2 in. deflection. Remaining hangers shall be spring or combination spring and elastomeric with 0.75 in. deflection. The first two hangers adjacent to the equipment shall be the positioning or pre-compressed type. Provide positioning hangers for all isolated piping 8 in. and larger. Piping over 2 inches in diameter suspended below or within 50 ft of conference rooms, classrooms and auditorium areas shall be hung with isolation hangers.

B. Vibration isolators for floor-supported piping:
   1. Provide vibration isolators for floor supports for piping in equipment rooms to isolate equipment. Isolators shall be selected according to the guidelines for hangers. The first two adjacent floor supports shall be the restrained spring type, with a restraint/blocking feature to prevent load transfer to equipment flanges as the piping is filled or drained. Provide a slide plate where pipe is subjected to large thermal movement (PTFE, graphite, or steel) and shall be installed on top of the isolator. Provide a thermal barrier when rubber products are installed directly beneath steam or hot-water lines.

3.4 SCHEDULE

A. Provide vibration isolators and equipment bases for all rotating, piston driven or vibrating equipment in accordance with the following schedules. Selection of equipment isolators shall be based on approved equipment shop drawings.

B. This section does not apply to surface mounted, fractional horsepower HVAC equipment such as ceiling fans and VRF cassette units; install per manufacturers' instructions.

Base & Isolator Types			
Base Types		Isolator Types	
None	No base, isolators attached directly to equipment. Suspend equipment securely from structure or floor-mount equipment on concrete housekeeping pad.	EL	Elastomeric pad, floor mount or hanger. Use restrained elastomeric mount where seismic restraint is required.
Steel	Structural steel rails or base.	Spring	Spring floor isolator or hanger. Use restrained spring isolator where seismic restraint is required.
Inertia Base	Concrete inertia base.		
Curb	Roof curb or curb rails		

Vibration Isolation - Pumps												
Type	HP	RPM	Equipment Location									Table Notes
			Slab on grade			Indoors, mounted to structure			Roof			
			Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	
Close Coupled	≤7.5	All	N/A	N/A	N/A	None	Spring	0.75	N/A	N/A	N/A	2
	≥10	All	N/A	N/A	N/A	None	Spring	1.5	N/A	N/A	N/A	2
Base-mounted Inline	5 to 25	All	N/A	N/A	N/A	None	Spring	1.5	N/A	N/A	N/A	2
	≥30	All	N/A	N/A	N/A	Inertia Base	Spring	2.5	N/A	N/A	N/A	1
End suction and split case	≤40	All	N/A	N/A	N/A	Inertia Base	Spring	1.5	N/A	N/A	N/A	1
	50 to 125	All	N/A	N/A	N/A	Inertia Base	Spring	2.5	N/A	N/A	N/A	1
	≥150	All	N/A	N/A	N/A	Inertia Base	Spring	3.5	N/A	N/A	N/A	1

Notes:

1. Pumps: Concrete Inertia bases strength and shape shall accommodate base elbow supports. Concrete Inertia bases shall be designed for a thickness of one-tenth the longest dimension with minimum thickness as follows: (1) for up to 30 hp, 6 in.; (2) for 40 to 75 hp, 8 in.; and (3) for 100 hp and up, 12 in. Pumps over 75 hp and multistage pumps shall be provided with supplemental restraining devices.
2. Spring isolators shall be provided for pumps suspended from structure. Floor mounted pumps do not require spring isolators.

Vibration Isolation - Axial Fans												
Type	Static Pres-sure	RPM	Equipment Location									Table Notes
			Slab on Grade			Upper Floor			Roof			
			Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	
Up to 22 in. diameter	All	All	None	EL	0.25	None	Spring	0.75	Curb or Steel	Spring	0.75	1,3
24 in. diameter & up	≤2 in. SP	Up to 300	Steel	Spring	2.5	Steel	Spring	3.5	Curb or Steel	Spring	3.5	3
		300 to 500	Steel	Spring	0.75	Steel	Spring	1.5	Curb or Steel	Spring	1.5	3
		501 and up	Steel	Spring	0.75	Steel	Spring	1.5	Curb or Steel	Spring	1.5	3
	≥2.1 in. SP	Up to 300	Inertia Base	Spring	2.5	Inertia Base	Spring	3.5	Curb or Steel	Spring	3.5	3
		300 to 500	Inertia Base	Spring	1.5	Inertia Base	Spring	1.5	Curb or Steel	Spring	1.5	2,3
		501 and up	Inertia Base	Spring	0.75	Inertia Base	Spring	1.5	Curb or Steel	Spring	1.5	2.3

Notes:

1. Where equipment manufacturer indicates component cannot be installed directly on individual isolators provide equipment manufacturer recommended supplemental support (base type).
2. Select isolator deflection so that resonance frequency is 40 percent or less of the lowest normal operating speed of equipment. Add a 1 in. thick pad to the base plate of spring isolators.
3. To limit undesirable movement, thrust restraints are required for all ceiling-suspended and floor-mounted units operating at 2 in. of water or more total static pressure.

Vibration Isolation – Centrifugal and Mixed-Flow Fans												
Type	HP	RPM	Equipment Location									Table Notes
			Exterior, Slab on Grade			Indoors			Roof			
			Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	
Up to 22 in. diameter	All	All	Steel	EL	0.25	Steel	Spring	0.75	Curb or Steel	Spring	0.75	3
24 in. diameter & up	≤40	Up to 300	Steel	Spring	2.5	Steel	Spring	3.5	Curb or Steel	Spring	3.5	2
		300 to 500	Steel	Spring	1.5	Steel	Spring	1.5	Curb or Steel	Spring	1.5	2
		501 and up	Steel	Spring	0.75	Steel	Spring	0.75	Curb or Steel	Spring	0.75	2
	≥50	Up to 300	Inertia Base	Spring	2.5	Inertia Base	Spring	3.5	Curb or Steel	Spring	3.5	1,2,3
		300 to 500	Inertia Base	Spring	1.5	Inertia Base	Spring	1.5	Curb or Steel	Spring	1.5	1,2,3
		501 and up	Inertia Base	Spring	1.0	Inertia Base	Spring	1.5	Curb or Steel	Spring	1.5	1,2,3
Roof Curb Mounted Ventilators	All	All	N/A	N/A	N/A	N/A	N/A	N/A	Curb	None	N/A	

Notes:

1. Increase isolator deflection so isolator stiffness is less than one-tenth the stiffness of the supporting structure, as defined by the deflection due to load at the equipment support.
2. Select isolator deflection so that resonance frequency is 40 percent or less of the lowest normal operating speed of equipment. Add a 1 in. thick pad to the base plate of spring isolators.
3. Provide thrust restraints for all ceiling-suspended and floor-mounted units operating at 2 in. of water or more total static pressure.

General Note for Fans: For fans operating under 300 rpm, select isolator deflection so the isolator natural frequency is 40 percent or less than the fan speed. Flexible duct connectors shall be installed at the intake and discharge of all fans and air-handling equipment to reduce vibration transmission to air duct structures. Provide thrust restraints with same deflection as isolators for all fans and all base-mounted and suspended air-handling equipment operating at 2 in. or more total static pressure. Adjust restraint movement under normal operational static pressures.

Vibration Isolation – Propeller Fans												
Type	HP	RPM	Equipment Location									Table Notes
			Exterior, Slab on Grade			Indoors			Roof			
			Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	
Wall-mounted	All	All	None	None	None	None	EL	0.25	None	EL	0.25	
Roof-mounted	All	All	None	None	None	Steel or Curb	Spring	1.5	Curb or Steel	Spring	1.5	

Vibration Isolation – Air-Cooled Condensing Units												
Type	Tons	RPM	Equipment Location									Table Notes
			Exterior, Slab on Grade			Indoors			Roof			
			Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	
Individual Condensing Units	≤5	All	None	EL	0.25	N/A	N/A	N/A	Curb or Steel	EL	0.25	1
	>5-<10	All	None	EL	0.25	N/A	N/A	N/A	Curb or Steel	Spring	0.75	1
	≥10	All	None	EL	0.25	N/A	N/A	N/A	Curb or Steel	Spring	1.5	1
Multi-split and VRF Condensing Units	All	All	None	EL	0.25	N/A	N/A	N/A	Curb or Steel	EL	0.25	1

Notes:

1. Where available, use of equipment manufacturer internal isolators meeting the above requirements is acceptable. Coordinate with equipment manufacturer. Provide documentation in both equipment submittals and in submittals for this Section.

Vibration Isolation – Air Handling Units (Including AHU, DOAS, RTU, MAU, BCU, H&V Units)												
Type	Fan HP, Static Pressure	RPM	Equipment Location									Table Notes
			Slab on Grade			Indoors			Roof			
			Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	
All	≤10	All	None	Spring	0.75	None	Spring	0.75	Curb or Steel	Spring	0.75	5
	≥15, ≤4 in. SP	Up to 300	None	Spring	0.75	None	Spring	3.5	Curb or Steel	Spring	3.5	1,3, 4,5
		300 to 500	None	Spring	0.75	None	Spring	2.5	Curb or Steel	Spring	2.5	3,5
		501 and up	None	Spring	0.75	None	Spring	1.5	Curb or Steel	Spring	1.5	3,5
	≥15, ≥4 in. SP	Up to 300	None	Spring	0.75	None	Spring	3.5	Curb or Steel	Spring	3.5	1,2, 3,4, 5
		300 to 500	None	Spring	0.75	None	Spring	2.5	Curb or Steel	Spring	2.5	1,2, 3,5
		501 and up	None	Spring	0.75	None	Spring	1.5	Curb or Steel	Spring	2.5	1,2, 3,5

Notes:

2. Where available, use of packaged equipment manufacturer internal isolators meeting the above requirements is acceptable. Coordinate with equipment manufacturer. Provide documentation in both equipment submittals and in submittals for this Section.
3. Increase isolator deflection so isolator stiffness is less than one-tenth the stiffness of the supporting structure, as defined by the deflection due to load at the equipment support.
4. Where equipment manufacturer indicates component cannot be installed directly on individual isolators provide equipment manufacturer recommended supplemental support (base type).
5. Select isolator deflection so that resonance frequency is 40 percent or less of the lowest normal operating speed of equipment. Add a 1 in. thick pad to the base plate of spring isolators.
6. Provide thrust restraints for all ceiling-suspended and floor-mounted units operating at 2 in. of water or more total static pressure.

General Note for Air-Handling Equipment: For fans operating under 300 rpm, select isolator deflection so the isolator natural frequency is 40 percent or less than the fan speed. Flexible duct connectors shall be installed at the intake and discharge of all fans and air-handling equipment to reduce vibration transmission to air duct structures. Provide thrust restraints with the same deflection as isolators for all fans and all base-mounted and suspended air-handling equipment operating at 2 in. or more total static pressure. Adjust restraint movement under normal operational static pressures.

Vibration Isolation – Ducted Rotating Equipment												
Type	Airflow (CFM)	RPM	Equipment Location									Table Notes
			Exterior, Slab on Grade			Indoors			Roof			
			Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	Base Type	Isolator Type	Min Defl., (in.)	
Fan-powered VAV boxes	≤600	All	N/A	N/A	N/A	None	EL	0.25	N/A	N/A	N/A	
Suspended Fan coil units Suspended Cabinet heaters and unit heaters	≥601 - 2000	All	N/A	N/A	N/A	None	Spring	0.75	N/A	N/A	N/A	
Floor-Mounted Fan coil units	≤600	All	N/A	N/A	N/A	None	EL	0.25	N/A	N/A	N/A	
Floor-Mounted Cabinet heaters and unit heaters	≥601 - 2000	All	N/A	N/A	N/A	None	EL	0.25	N/A	N/A	N/A	
Small in-line fans	≤600	All	N/A	N/A	N/A	None	EL	0.25	N/A	N/A	N/A	

END OF SECTION

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Duct Markers.

D. Pipe markers.

E. Warning Signs and Labels

F. Warning Tags

G. Radon Labels

H. Ceiling Tacks

1.2 RELATED REQUIREMENTS

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

B. Division 09- Finishes.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials.

1.4 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents:
   1. Valve Schedules: For each piping system. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-

operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

2. Equipment Schedules: For each item of equipment to be labeled. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

PART 2 PRODUCTS

2.1 EQUIPMENT NAMEPLATES

A. Manufacturers:
1. Advanced Graphic Engraving, LLC
2. Brimar Industries, Inc; Kolbi Pipe Marker Co.
3. Seton Identification Products

B. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inchor anodized aluminum, 0.032-inchminimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inchfor viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Plastic Labels for Equipment:

1. Material and Thickness: Conform to ASTM D709. Multilayer, multicolor, plastic labels for mechanical engraving, minimum 1/16 inchthick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
6. Minimum Letter Size: 1/4 inchfor name of units if viewing distance is less than 24 inches, 1/2 inchfor viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

D. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 TAGS

A. Manufacturers:
1. Advanced Graphic Engraving
2. Brady Corporation
3. Brimar Industries, Inc
4. Kolbi Pipe Marker Co
5. Seton Identification Products, a Tricor Company
6. Substitutions: See Division 01-General Requirements.

B. Metal Tags: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware. Brass wire-link, beaded chain or S-hook fasteners. Minimum 1-1/2 inch diameter with smooth edges.

2.3 DUCT MARKERS

A. Manufacturers:
1. Brimar Industries, Inc
2. Kolbi Pipe Marker Co
3. Seton Identification Products

B. General Requirements for Manufactured Duct Labels: Preprinted self-adhesive, premium grade vinyl, color-coded, with lettering indicating service, and showing flow direction.

C. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch printed with UV and chemical resistant inks.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

F. Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: Prepared with letter sizes according to ASME A13.1, at least 1-1/2 incheshigh.

2.4 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation
2. Brimar Industries, Inc
3. Kolbi Pipe Marker Co
4. MIFAB, Inc
5. Seton Identification Products

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Prepared with letter sizes according to ASME A13.1, at least 1-1/2 incheshigh.

2.5 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inchthick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inchfor name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Reinforced grommet and wire or string.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Red, white, black.

2.7 RADON LABELS

A. Radon pipe discharge shall be provided with labeling similar to the following:
1. Caution, radon discharged fumes do not breathe fumes.

B. Radon fan and associated equipment shall be provided with labeling similar to the following:
1. Caution, this is a component of radon reduction system, don to alter or disconnect.

C. Radon fan power and electrical devices shall be provided with labeling similar to the following:
1. Caution, radon fan circuit do not turn off.

D. Radon fan switch shall be provided with labeling similar to the following:
1. Caution, radon fan switch, leave on.

E. Radon reduction system labels shall be provided with labeling similar to the following:
1. Labeling with information for:
a. Installed By:
b. Phone number:
c. Installation Date:
d. License / Certificate #:
e. Initial Vacuum pressure:
f. Note: It is advised that this building be tested for radon at least every two years as required or recommend by state and local agencies.

2.8 CEILING TACKS

A. Manufacturers:
1. Brimar
2. Craftmark

B. Seton Identification ProductsDescription: Steel with 3/4 inch diameter color coded head.

C. Color code as follows:
1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.
3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment, including all scheduled equipment on the drawings, air terminal units, automatic control devices, control panels, instruments, relays and major control components.

B. Locate equipment labels where accessible and readable from the floor.

C. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

3.3 VALVE TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application:

1. Valve-Tag Size and Shape: 1-1/2 inches, round.

2. Valve-Tag Color: Natural

3. Letter Color: Black

3.4 PIPE LABEL INSTALLATION

A. Install plastic pipe markers in accordance with manufacturer's instructions.

B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Pipe Label Color Schedule:

1. Potable, Cooling, Heating and Other Water Piping:

a. Background Color: Green.
b. Letter Color: White.

2. Combustible Fluid Piping:

a. Background Color: Brown.
b. Letter Color: White.

3. Flammable & Oxidizing Fluid Piping:

a. Background Color: Yellow.
b. Letter Color: Black.

4. Toxic & Corrosive Piping:

a. Background Color: Orange.
b. Letter Color: Black.

F. Identify valves in main and branch piping with tags.

3.5 DUCT LABEL INSTALLATION

A. Install duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 CEILING TACK INSTALLATION

A. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Vibration measurement of equipment operating conditions.

1.2 RELATED REQUIREMENTS

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

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. AABC (NSTSB) - AABC National Standards for Total System Balance

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems;.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing;.

1.4 SUBMITTALS

A. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Submit to the Commissioning Authority.
   3. Submit to Engineer of Record.
   4. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   5. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   6. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.

b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
d. Identification and types of measurement instruments to be used and their most recent calibration date.
e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
f. Final test report forms to be used.
g. Detailed step-by-step procedures for TAB work for each system and issue, including:
    1) Terminal flow calibration (for each terminal type).
    2) Diffuser proportioning.
    3) Branch/submain proportioning.
    4) Total flow calculations.
    5) Rechecking.
    6) Diversity issues.
h. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
i. Details of how TOTAL flow will be determined; for example:
    1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
    2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
k. Confirmation of understanding of the outside air ventilation criteria under all conditions.
l. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
m. Method of checking building static and exhaust fan and/or relief damper capacity.
n. Methods for making coil or other system plant capacity measurements, if specified.
o. Time schedule for TAB work to be done in phases (by floor, etc.).
p. Description of TAB work for areas to be built out later, if any.
q. Time schedule for deferred or seasonal TAB work, if specified.
r. False loading of systems to complete TAB work, if specified.
s. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
t. Interstitial cavity differential pressure measurements and calculations, if specified.
u. differential pressure measurements and calculations between the building and its exterior.
v. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
w. Procedures for formal progress reports, including scope and frequency.

x. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit under provisions of Division 01 – General Conditions.
2. Submit to the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
3. Revise TAB plan to reflect actual procedures and submit as part of final report.
4. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and Engineer of Record and for inclusion in operating and maintenance manuals.
5. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
6. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
7. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
8. Units of Measure: Report data in both I-P (inch-pound) units.
9. Include the following on the title page of each report:
   a. Name of Testing, Adjusting, and Balancing Agency.
   b. Address of Testing, Adjusting, and Balancing Agency.
   c. Telephone number of Testing, Adjusting, and Balancing Agency.
   d. Project name.
   e. Project location.
   f. Project Architect.
   g. Project Engineer.
   h. Project Contractor.
   i. Project altitude.
   j. Report date.

E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC (NSTSB), AABC National Standards for Total System Balance.

2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
4. SMACNA (TAB)Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:
   a. AABC, Associated Air Balance Council completion submit AABC National Performance Guaranty.
   b. NEBB, National Environmental Balancing Bureau
   c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps and fans are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

3.3 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers and control providers whose work will be tested, adjusted, or balanced.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

H. Check and adjust systems approximately two seasons after final acceptance and submit report.

3.6 AIR SYSTEM PROCEDURE

A. Work with Control vendor to establish minimum setpoints necessary to satisfy contract documents. Iterative testing to determine these minimum setpoints will be expected to be in the submittals.

B. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

C. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

D. Measure air quantities at air inlets and outlets.

E. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

F. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

G. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.7 COMMISSIONING

A. See Division 01 General Requirements for additional requirements.

3.8 SCOPE

A. Test, adjust, and balance the following:
1. Plumbing Pumps.
2. HVAC Pumps.
3. Air Cooled Refrigerant Condensers.
4. Packaged Roof Top Heating/Cooling Units.
5. Packaged Terminal Air Conditioning Units.
6. Variable Refrigerant Volume/Flow Systems (VRF or VRV)
7. Computer Room Air Conditioning Units.
8. Air Coils.
9. Air Handling Units.
10. Fans.
11. Air Filters.

12. Air Terminal Units.
13. Air Inlets and Outlets.

3.9 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.
9. VFD Setpoints.
10. ECM Setpomts.

B. V-Belt Drives:
1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:
1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

D. Air Cooled Condensers:
1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

E. Electric Duct Heaters:
   1. Manufacturer.
   2. Identification/number.
   3. Location.
   4. Model number.
   5. Design kW.
   6. Number of stages.
   7. Phase, voltage, amperage.
   8. Test voltage (each phase).
   9. Test amperage (each phase).
   10. Air flow, specified and actual.
   11. Temperature rise, specified and actual.

F. Air Moving Equipment:
   1. Location.
   2. Manufacturer.
   3. Model number.
   4. Serial number.
   5. Arrangement/Class/Discharge.
   6. Air flow, specified and actual.
   7. Return air flow, specified and actual.
   8. Outside air flow, specified and actual.
   9. Total static pressure (total external), specified and actual.
   10. Inlet pressure.
   11. Discharge pressure.
   12. Sheave Make/Size/Bore.
   13. Number of Belts/Make/Size.
   14. Fan RPM.

G. Return Air/Outside Air:
   1. Identification/location.
   2. Design air flow.
   3. Actual air flow.
   4. Design return air flow.
   5. Actual return air flow.
   6. Design outside air flow.
   7. Actual outside air flow.
   8. Return air temperature.
   9. Outside air temperature.
   10. Required mixed air temperature.
   11. Actual mixed air temperature.
   12. Design outside/return air ratio.
   13. Actual outside/return air ratio.

H. Exhaust Fans:
   1. Location.
   2. Manufacturer.
   3. Model number.
   4. Serial number.
   5. Air flow, specified and actual.

6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

I. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

J. Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
   a. Blower.
   b. Orifice, tube size.
   c. Orifice size.
   d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

K. Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

L. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.

4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION

SECTION 230700 - HVAC INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. HVAC piping insulation, jackets and accessories.

B. HVAC equipment insulation, jackets and accessories.

C. HVAC ductwork insulation, jackets, and accessories.

1.2 RELATED REQUIREMENTS

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

B. Division 07 – Firestopping

C. Division 09- Finishes

D. Section 23 0553- Identification of HVAC Piping and Equipment

E. Section 23 3100- HVAC ducts and casings

1.3 REFERENCES STANDARDS (follow the most currently adopted amended version)

A. ASTM International:
1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
2. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
3. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
4. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
5. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
6. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
7. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
8. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
9. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
10. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
11. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
12. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

13. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
14. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
15. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
16. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
17. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
18. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
19. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
20. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
21. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors':
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. Underwriters Laboratories Inc.:
1. UL 1978 - Standard for Safety for Grease Ducts.

1.4 SUBMITTALS

A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

D. Surface Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

E. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

F. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping. Store all insulation materials in a clean, dry environment.

1.8 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23.

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. For fire-rated duct insulation, insulation manufacturer shall forward to the sheetmetal contractor specific sheetmetal and hanger requirements needed to meet UL Listing of the fire-rated insulation system including but not limited to minimum sheetmetal gauge of fire-rated insulated duct sections, specific sheetmetal joint construction requirements and specific hanger requirements.

D. Coordinate clearance requirements with equipment Installer for equipment insulation application. Coordinate installation and testing of equipment heat tracing.

E. Coordinate clearance requirements with piping Installer for piping insulation application. Coordinate installation and testing of piping heat tracing.

1.9 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 SCHEDULING

A. Schedule insulation application after pressure and leak testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturers for Flexible Glass Fiber (FGF), Pre-Molded Glass Fiber (PGF) and Rigid Glass Fiber (RGF) Insulation Products:
   1. Knauf Insulation
   2. Johns Manville Corporation
   3. Owens-Corning.

B. Manufacturers for Closed Cell Elastomeric (CCE) Insulation Products:
   1. Aeroflex. USA, Inc.
   2. Armacell, LLC (Interior- ArmaFlex, Exterior- ArmaTuff)
   3. K-Flex USA LLC

C. Manufacturers for Polyisocyanurate Foam Insulation Products:
   1. Dow Chemical Company.
   2. Owens-Corning
   3. Johns Manville Corporation
   4.

D. Manufacturers for Fire Rated (FR) Insulation Products:
   1. 3M Fire Barrier Duct Wrap 615+.
   2. Morgan Theramal Ceramics Pyroscat DuctWrap XL.
   3. Unifrax FyreWrap Elite 1.5.

E. Manufacturers for PVC Jacketing (PVC):
   1. Johns Manville
   2. P.I.C. Plastics Inc.
   3. Proto Corporation

F. Manufacturers for Aluminum Jacketing (ALM):
   1. Childers Brand
   2. ITW Insulation Systems
   3. RPR Products

G. Manufacturers for Self-Adhesive Waterproof Jacketing (SWJ):
   1. Polyguard Products, Inc.; Alumaguard 60.
   2. Venture Tape Corporation; VentureClad Plus.
   3. MFM Building Products Corp: Flex Clad 400

2.2 PIPE INSULATION

A. Pre-Molded Glass Fiber (PGF) Insulation:
   1. ASTM C547 and ASTM C795, rigid molded, noncombustible.
   2. 'K' ('Ksi') Value: ASTM C177, 0.24 at 75°F.
   3. Maximum Service Temperature: 850°F.
   4. Maximum Moisture Absorption: 0.2 percent by volume.
   5. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; self-sealing lap, moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (ASJ-SSL).

B. Closed Cell Elastomeric (CCE) Insulation:
   1. Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
   2. Minimum Service Temperature: Minus 40°F.
   3. Maximum Service Temperature: 220°F.
   4. Connection: Waterproof vapor barrier adhesive.

2.3 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: hydrous calcium silicate. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.

F. Valve insulation Wraps: White, noncombustible, conforming to ASTM E 84. Match insulation thickness to pipe size. Valve covers shall be easily removable.

2.4 EQUIPMENT INSULATION

A. Closed Cell Elastomeric (CCE) Insulation:
   1. Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3, in sheet form.
   2. Minimum Service Temperature: -40°F.
   3. Maximum Service Temperature: 220°F.
   4. Connection: Waterproof vapor barrier adhesive.

2.5 EQUIPMENT INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

E. Pump body insulation: Provide insulation for pump body and components on chilled water systems. Provide pre-cut insulation from manufacturer or provide field fabricated insulation to ensure pump body and components are completely protected.

F. Adhesives: Compatible with insulation. Refer to manufacturers' installation manual.

2.6 DUCTWORK INSULATION

A. Flexible Glass Fiber (FGF) Insulation: ASTM C553 Type I, II, or III, ASTM C1290 Type III, in accordance to NFPA 90A and NFPA 90B for duct coverings, with ASTM C1136 foil scrim kraft (FSK).
1. Thermal performance: 1.0 lb/ft^3, 7.4 ft^2 hr °F/btu minimum R-value for 2" thick at 75°F mean temperature per ASTM C177 and ASTM C518.
2. Operating temperature range: 40°F to 250°F.
3. Water vapor permeance: 0.02 perms maximum per ASTM E96.
4. Water vapor sorption: 5% by weight maximum per ASTM C1104.
5. Corrosiveness: Does not accelerate per ASTM C665.
6. Fungi growth: No fungi growth per ASTM C1338.

B. Rigid Glass Fiber (RGF) Insulation: Glass fiber board, ASTM C 612 Type 1A or 1B, in accordance to NFPA 90A and NFPA 90B for duct coverings, with ASTM C 1136 foil scrim kraft (FSK).
1. Thermal performance: 8.7 ft^2 hr °F/btu minimum R-value for 2" thick at 75°F mean temperature per ASTM C177 and ASTM C518.
2. Operating temperature range: 0°F to 450°F.
3. Water vapor permeance: 0.02 perms maximum per ASTM E96.
4. Water vapor sorption: 5% by weight maximum per ASTM C1104.
5. Corrosiveness: Does not accelerate per ASTM C665.
6. Fungi growth: No fungi growth per ASTM C1338.

C. Closed Cell Elastomertic (CCE) Insulation:
1. Thermal performance: 8.0 ft^2 hr °F/btu minimum R-value for 2" thick at 75°F mean temperature per ASTM C177 and ASTM C518.
2. Operating temperature range: -40°F to 220°F.
3. Water absorption: 0.2% by volume per ASTM C 209 or ASTM C1763.
4. Water vapor permeability: 0.08 perm-in per ASTM E 96.
5. Ultraviolet (UV) resistance: Excellent per ASTM G 53 or ASTM G 90.
6. Weatherability: Excellent per ASTM D 471.

D. Fire Rated (FR) Insulation:
1. Inorganic blanket encapsulated with scrim reinforced foil meeting UL 1978
2. Thermal Conductivity: 0.42 at 500°F.
3. Weight: 1.4 pound per square foot.
4. Surface Burning Characteristics: Maximum 0/0 flame spread/smoke developed index when tested in accordance with ASTM E84.
5. Technical Data:
   a. Insulation shall pass when tested in accordance with the following:
      1) Non-combustibility per ASTM E136.
      2) Fire resistance (wall) per ASTM E119.

3) Durability test per ASTM C518.
4) Internal fire test per ASTM E2336.
5) Fire engulfment (duct) per ASTM E814.
6) ULC grease duct test protocol.
7) Grease duct clearances per UL1978.
8) Air duct ventilation enclosure per ISO6944.

b. Thermal performance: 6.3 ft^2 hr °F/btu minimum R-value for 1-1/2" thick at 75°F mean temperature per ASTM C177 and ASTM C518.

2.7 DUCTWORK INSULATION ACCESSORIES

A. Vapor Retarder Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

B. Vapor Retarder Lap Adhesive: Compatible with insulation.

C. Adhesive: Waterproof, ASTM E162 fire-retardant type.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with head.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Lagging Adhesive: Fire retardant type with maximum 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.

H. Adhesives: Compatible with insulation.

I. Membrane Adhesives: As recommended by membrane manufacturer.

2.8 FIELD-APPLIED JACKET

A. Polyvinyl-chloride Jacket (PVC):
1. Description: ASTM D1785, roll stock ready for shop or field cutting and forming, white color.
2. Fittings: One piece molded type fitting covers, white color.
3. Finish: Gloss
4. Service Temperatures: 0°F - 150°F.
5. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
6. Thickness: 10 mil for indoor applications, 30 mil for outdoor applications.
7. Connections: Pressure sensitive color matching vinyl tape.

B. Aluminum Jacket (ALM):
1. Description: ASTM B209 Alloy 3003, 3005, 3105, or 5005, Temper H-14
2. Thickness: 0.020 inch thick sheet.
3. Finish: Smooth.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.020 inch thick die shaped aluminum fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.02 inch thick aluminum.

C. Self-Adhesive Waterproofing Jacket (SWJ):
   1. Description: Minimum 12 mil thick, vapor barrier and waterproofing membrane for installation over insulation; UV resistant, impact and tear resistant.
   2. Water Vapor Permeance: ASTM E96/E96M; 0.00 perms.
   3. Finish: textured aluminum-foil facing

PART 3 EXECUTION

3.1 EXAMINATION

A. Protect insulation from exposure to moisture prior to and after installation. All insulation other than flexible elastomeric that becomes wet shall be replaced at no cost to the project.

B. Verify piping, equipment and ductwork has been tested before applying insulation materials.

C. Verify piping, equipment and ductwork surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Piping Exposed to View in Finished Spaces Provide with PVC Plastic pipe jacketing for additional protection. Locate insulation and cover seams in least visible locations.

D. Piping Exposed to view in mechanical spaces. Provide with PVC Plastic pipe jacketing for additional protection. Locate insulation and cover seams in least visible locations.

E. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 for penetrations of assemblies with fire resistance rating greater than one hour.

F. Piping Systems Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

G. For all hot piping conveying fluids, insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature.
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Insulation Terminating Points:
   1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
   2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
   3. Condensate Piping: Insulate entire piping system and components to prevent condensation.

K. Closed Cell Elastomeric Insulation:
   1. Push insulation on to piping.
   2. Miter joints at elbows.
   3. Seal seams and butt joints with manufacturer's recommended adhesive.
   4. When application requires multiple layers, apply with joints staggered.
   5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

L. Install valve bags on all chilled water valves unless otherwise indicated. Valve bags shall be easily removable for servicing of valves.

M. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Containing Fluids Below Ambient Temperature:
   1. Insulate entire equipment surfaces.
   2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
4. Finish insulation at supports, protrusions, and interruptions.

E. Equipment Containing all Fluids Above Ambient Temperature:
1. Insulate flanges and unions with removable sections and jackets.
2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
3. Finish insulation at supports, protrusions, and interruptions.

F. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

G. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.4 INSTALLATION - DUCTWORK SYSTEMS

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Protect insulation from exposure to moisture prior to and after installation. All insulation other than flexible elastomeric that becomes wet shall be replaced at no cost to the project.

D. Duct dimensions indicated on Drawings are finished inside dimensions.

E. Insulated ductwork conveying air below ambient temperature:
1. Provide insulation with vapor retarder jackets.
2. Finish with tape and vapor retarder jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

F. Insulated ductwork conveying air above ambient temperature:
1. Provide with or without standard vapor retarder jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

G. External Elastomeric Duct Insulation:
1. Adhere to clean oil-free surfaces with full coverage of adhesive.
2. Seal seams and butt joints with manufacturer’s recommended adhesive.
3. When application requires multiple layers, apply with joints staggered.
4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
5. Lift ductwork off trapeze hangers and insert spacers.

H. Kitchen Exhaust Ductwork:

1. Cover duct by wrapping with insulation using overlap method and butt joint with collar method.
2. Overlap seams of each method by 3 inches.
3. Attach insulation using steel banding or by welded pins and clips.
4. Install insulation without sag on underside of ductwork. Use additional fasteners to prevent sagging.

I. Ducts Exterior to Building:
1. Install insulation according to external duct insulation paragraph above.
2. Provide external insulation with vapor retarder jacket. Cover with outdoor jacket finished with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
3. Finish with aluminum duct jacket.
4. Calk seams at flanges and joints. Located major longitudinal seams on bottom side of horizontal duct sections.

J. Prepare duct insulation for finish painting. Refer to Division 09.

3.5 DUCTWORK INSULATION SCHEDULES

A. Items Not Insulated:
1. Fibrous-glass ducts.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

B. Provide insulation materials and thicknesses identified below. If more than one material is listed for a duct location, selection from materials listed is Division 23 option.

Heating and Cooling Supply and Heat/Energy Recovery System Exhaust Ducts Climate Zone 1				
Description	Minimum As-Installed R-Value	Insulation Type	Minimum Thickness (inches)	Jacketing
Exterior to building envelope	R-8.0	Closed Cell Elastomeric (CCE)	2.0	ALM or SWJ
Concealed within thermal envelope of building	R-6.0	Flexible Glass Fiber (FGF)	2.0	FSK
Exposed in mechanical rooms	R-6.0	Rigid Glass Fiber (RGF)	2.0	FSK

Unconditioned Outside Air Intake Ducts and Exhaust/Relief Duct Inside Building Envelope Climate Zones 1				
Description	Minimum As-Installed R-Value	Insulation Type	Minimum Thickness (inches)	Jacketing
For outside air intakes, all ductwork between the building envelope and the first system heating coil, cooling coil or air handling unit connection.	R-8.0	Flexible Glass Fiber (FGF)	3.0	FSK
		Rigid Glass Fiber (RGF)	3.0	FSK
For exhaust/relief ducts, all ductwork between the building envelope and first system isolation damper.	R-6.0	Flexible Glass Fiber (FGF)	3.0	FSK
		Rigid Glass Fiber (RGF)	3.0	FSK

Oven, Dishwash, Warewash and Shower Exhaust Ducts Climate Zone 1				
Description	Minimum As-Installed R-Value	Insulation Type	Minimum Thickness (inches)	Jacketing
Concealed in unconditioned spaces including shafts, mechanical spaces, non-plenum return ceiling cavities and crawlspaces (ventilated and non-ventilated)	R-3.5	Flexible Glass Fiber (FGF)	1.5	FSK

Concealed, Type I (Grease), Commercial, Kitchen Hood Exhaust Duct and Plenums Climate Zones 0 Through 8				
Description	Minimum As-Installed R-Value	Insulation Type	Minimum Thickness (inches)	Jacketing
All ductwork.	N/A	Fire Rated (FR)	Number of Layers and Thickness Required to Meet 2-Hour Fire Rating for Grease Ducts	N/A

3.6 DUCT LINER

A. See Section 23 3100 - HVAC Ducts and Casings, for duct liner specifications

3.7 PIPE INSULATION SCHEDULE

A. Provide insulation materials and thicknesses scheduled for each system type and pressure/temperature range. If more than one material is listed for a system, selection from materials listed is Division 23 option.

B. For dual temperature systems (heating and cooling), provide thickness equal to greater of heating or cooling scheduled value. Dual temperature piping shall also meet all vapor barrier requirements for cooling insulation (perm rating).

C. Insulation for pre-insulated piping shall meet all specified requirements.

D. Insulate piping operating at temperatures below 40°F and systems operating between 40°F to 65°F in accordance with NAIMA Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation. Comply with all recommendations including but not limited to the requirement for vapor dams every fourth section of insulation.

Heating Hot Water Systems					
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Outdoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Closed Cell Elastomeric	Less than 1 to 1.5	1.5	3.0	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms. Outdoor: ALM

	1.5 and Larger	2.0	4.0		

Cooling Coil Condensate Piping and Equipment Drain Piping: All					
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Outdoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Closed Cell Elastomeric (CCE)	All Sizes	0.75	2.0	N/A	Indoor (CCE): N/A Outdoor (CCE): ALM

Refrigerant Piping					
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Outdoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Closed Cell Elastomeric (CCE)	Less than 3	1.0	1.0	N/A	Indoor: N/A Outdoor: ALM

3.8 EQUIPMENT INSULATION SCHEDULE

A. Provide insulation materials and thicknesses scheduled for each system type and pressure/temperature range. If more than one material is listed for a system, selection from materials listed is Division 23 option.

END OF SECTION

SECTION 230800 - COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 SUMMARY

A. See Division 01 - General Requirements.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
1. Control system.
2. Major and minor equipment items.
3. Piping systems and equipment.
4. Ductwork and accessories.
5. Terminal units.
6. Sound control devices.
7. Vibration control devices.
8. Variable frequency drives.
9. Special Ventilation:
    a. Kitchen hoods
    b. Chemical storage fans
10. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
11. Indoor Air Quality Procedures: The Commissioning Authority will coordinate; Contractor will execute; see Division 01.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements.

B. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ASHRAE Guideline 1.1 - The HVAC&R Techincal Requirements for the Commissioning Process.

1.4 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:
      a. Process of verifying proper hardware and wiring installation.
      b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
      c. Process of performing operational checks of each controlled component.
      d. Plan and process for calibrating valve and damper actuators and all sensors.
      e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
   4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has "passed" and is operating within the contract parameters.
   5. Description of the instrumentation required for testing.
   6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
   2. Full as-built set of control drawings.
   3. Full as-built sequence of operations for each piece of equipment.
   4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
      a. Floor.
      b. Room number.
      c. Room name.
      d. Air handler unit ID.
      e. Reference drawing number.
      f. Air terminal unit tag ID.

g. Heating and/or cooling valve tag ID.
h. Minimum air flow rate.
i. Maximum air flow rate.

5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. 1Control equipment component submittals, parts lists, etc.
11. 1Warranty requirements.
12. 1Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. 1Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).

E. Project Record Documents: See Division 01 - General Requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Division 01, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Division 01 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in

order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.1 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Include cost of sheaves and belts that may be required for testing, adjusting, and balancing.

G. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

H. Provide temperature and pressure taps in accordance with the contract documents.
   1. Provide a pressure/temperature plug at each water sensor that is an input point to the control system.

3.2 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:
   1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
   2. Set pump/fan to normal operating mode.

3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
7. Closure for Heating Coil Valves - Normally Open:
    a. Set heating setpoint 20 degrees F above room temperature.
    b. Observe valve open.
    c. Remove control air or power from the valve and verify that the valve stem and actuator position do not change.
    d. Restore to normal.
    e. Set heating setpoint to 20 degrees F below room temperature.
    f. Observe the valve close.
    g. For pneumatics, by override in the control system, increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change.
    h. Restore to normal.
8. Closure for Cooling Coil Valves - Normally Closed:
    a. Set cooling setpoint 20 degrees F above room temperature.
    b. Observe the valve close.
    c. Remove control air or power from the valve and verify that the valve stem and actuator position do not change.
    d. Restore to normal.
    e. Set cooling setpoint to 20 degrees F below room temperature.
    f. Observe valve open.
    g. For pneumatics, by override in the control system, increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change.
    h. Restore to normal.

3.3 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.4 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of the Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with the contract documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
   2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:
   1. That all specified functions and features are set up, debugged and fully operable.
   2. That scheduling features are fully functional and setup, including holidays.
   3. That all graphic screens and value readouts are completed.
   4. Correct date and time setting in central computer.
   5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
   6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
   7. Power failure and battery backup and power-up restart functions.
   8. Global commands features.
   9. Security and access codes.
   10. Occupant over-rides (manual, telephone, key, keypad, etc.).
   11. O&M schedules and alarms.
   12. Occupancy sensors and controls.
   13. “After hours” use tracking and billing.
   14. Communications to remote sites.
   15. Fire alarm interlocks and response.
   16. Fire protection and suppression systems interfaces.
   17. Security system interlocks.

18. That points that are monitored only, having no control function, are reporting properly to the control system.
19. All control strategies and sequences not tested during controlled equipment testing.
20. Trend logging and graphing features that are specified.
21. Other integrated tests specified in the contract documents
22. That control system features that are included but not specified to be setup are actually installed.

H. Perform and submit trend logging on the following using the control system, for minimum period of 5 days including one weekend, if the control points are monitored by the control system:
1. Duty cycling, if specified.
2. Demand limiting, including over-ride of limiting.
3. Sequential staging ON of equipment; optionally demonstrate manually.
4. Optimum start-stop functions.
5. Miscellaneous equipment current or status for duty cycling and demand limiting.
6. Equipment or building kW or current for demand limiting.
7. Equipment optimum start/stop functions.

I. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.5 OPERATION AND MAINTENANCE MANUALS

A. See Division 01 General Requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.6 DEMONSTRATION AND TRAINING

A. See Division 01 General Requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:
   1. HVAC Control System: 24 hours.
   2. Piping Systems: 12 hours.
   3. Chemical Treatment: 2 hours.
   4. Control Air Compressors and Dryers: 2 hours.
   5. Air Handling Units: 4 hours.
   6. Variable Speed Drives: 4 hours.
   7. Supplementary Supply Fans: 2 hours.
   8. Return Fan/Relief Fan: 2 hours.
   9. Air Terminal Units: 2 hours.
   10. Packaged Rooftop Units: 2 hours.
   11. Computer Room AC Units: 2 hours.
   12. Split System AC or Heat Pumps: 2 hours.
   13. Specialty Exhaust Fans: 1 hours.
   14. Restroom Central Exhaust Fans: 1 hours.

E. TAB Review: Instruct Owner's personnel for minimum 8 hours, after completion of TAB, on the following:
   1. Review final TAB report, explaining the layout and meanings of each data type.
   2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
   3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
   4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
   5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of 8 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training may be held on-site or at the manufacturer's facility.
      b. If held off-site, the training may occur prior to final completion of the system installation.
      c. For off-site training, Contractor shall pay expenses of up to two attendees.
   2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 24 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.

c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
d. Every display screen, allowing time for questions.
e. Use of keypad or plug-in laptop computer at the zone level.
f. Use of remote access to the system via phone lines or networks.
g. Setting up and changing an air terminal unit controller.
h. Graphics generation.
i. Point database entry and modifications.
j. Understanding DDC field panel operating programming, when applicable.

3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 24 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

SECTION 230900 - INSTRUMENTATION AND CONTROLS FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. System Description

B. Operator Interface

C. General Purpose Digital Controllers

D. Unitary Or Terminal Digital Controllers

E. Input/Output Interface

F. Bridges And Routers

G. Gateways

H. Panels

I. Power Supplies And Line Filtering

J. Local Area Network (Lan)

K. System Software

L. Controller Software

M. Input Hardware

N. Parking Garage Co And No2 Monitoring System

O. Chiller Room Refrigerant Detection System

P. Thermostats

Q. Humidistats

R. Time Clocks

S. Control Valves

T. Dampers

U. Actuators

V. Wire, Cable And Network Accessories

1.2 RELATED REQUIREMENTS

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

B. This Section includes provision of control sequences for HVAC systems, subsystems, and equipment indicated on the drawings and other Division 23 specification sections.

C. Section 23 0400 – General Conditions for Mechanical Trades.

D. Section 28 3100 - Fire Detection and Alarm.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ANSI/CEA 709.1.D - Control Network Protocol Specification.

B. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks.

C. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; Revision G.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL (DIR) - Online Certifications Directory.

1.4 DEFINITIONS

A. Backbone: The high traffic density connectivity portion of the communication network.

B. Bridge: A device that connects two or more LAN segments at the physical and data link layers. This device may also perform message filtering if programmed to do so.

C. Browser: A computer program that accesses and displays information from the Internet or intranet.

D. Client: A system or device that makes use of another device for some particular purpose through a system request.

E. Device (BACnet): A device, real or virtual, that supports digital communication using the BACnet protocol. Examples would be an operator terminal, router, unitary controller, etc.

F. Ethernet: Ethernet is a widely used Local Area Network (LAN). Ethernet, which conforms to IEEE Standard 802.3.

G. Events: Changes in the state of an object, typically between Normal, Off-Normal, and Fault Condition. Events may be reported to other BACnet devices.

H. Firewall: A security mechanism placed at the connection between networks and/or at networks outside connections. The firewall restricts access to the network.

I. Gateway: A device that connects two or more dissimilar networks by message translation and signal conditioning, permitting information exchange among them. A gateway would be necessary to translate LonWorks messages to the BACnet form.

J. Gbps: Gigabits per second. A unit of data transfer speed equal to 1024 Mbps.

K. GUI: Graphical User Interface, a type of Operator Interface Device for a BAS.

L. Hertz: A unit of measure equal to an oscillation per second.

M. HTML: The source form used for documents on the Internet or on an intranet. HTML embeds commands that determine formatting along with the text to be displayed.

N. Instance: A number which uniquely identifies an object within a device (e.g., Analog Input No.1, No. 2, etc.). Device Objects are required to have an instance number that is unique to their internetwork. Instance numbers may range from 0 to 4194303.

O. ID: Identification (name, number, plate, or tag).

P. IP: Internet Protocol. The protocol that defines both the format of packets used on a TCP/IP internet or intranet and the mechanism for routing a packet to its destination.

Q. IP address: A 32-bit address assigned to a device that uses TCP/IP protocols.

R. Kbps: A unit of data transfer equal to 1024 bits per second.

S. LAN: A LAN is a network of interconnected hardware devices sharing resources within a relatively small geographic area.

T. Mbps: A unit of data transfer equal to 1024 Kbps.

U. MS/TP: The Master-Slave/Token-Passing EIA-485 LAN developed for BACnet by ASHRAE. Operates at 9600, 19.2K, 38.4K and 76.8 K BPS. Master nodes (devices) pass around a speaking token which entitles the holder to initiate BACnet messages. Slave nodes can only respond to messages from Masters.

V. Native BACnet: A Building Automation System that uses the BACnet protocol for its data transfer between hardware devices and operator interface devices.

W. Object Identifier: A 32-bit number which uniquely identifies an object within a device, or the device object internetwork-wide. 10 bits represent the object type and 22 bits the instance number.

X. PC: Personal Computer.

Y. Peer-to-Peer Communication: Communication between equals. In BACnet, application programs (performing the functions of the BACnet devices on which they run) in devices of the appropriate conformance class talk to each other as peers, using the Protocol Stacks to deliver their message to each other. Likewise, Network Layers may talk as peers to determine how to route messages.

Z. Physical Segment: A single continuous medium 9-wire to which BACnet nodes are attached.

AA. PID: Proportional Integral and Derivative.

BB. Protocol: A design that specifies the details of how digital devices interact.

CC. Repeater: A device that connects two or more physical segments of a LAN at the physical layer and exactly reproduces the electrical signals on either side so that nodes on either side of the repeater are considered to be on the same network.

DD. Router: A device which connects two or more networks, of same or different types, so that a BACnet message may be transferred across the appropriate networks to reach its destination.

EE. RS-232-C: The technical name of the standard for serial data connections such as those between a computer and a keyboard.

FF. Server: A computer or hardware device which stores the resources accessed by other computers or hardware devices (clients).

GG. TCP/IP: The protocol suite used in the Internet. Although the suite contains many protocols, TCP and IP are two of the most important.

HH. Unitary Controller: Devices which controls and/or monitors a single piece of equipment.

II. WEB: A synonym for the World Wide Web. In modern usage pertains to both the Internet and to intranets using the TCP/IP Protocol.

1.5 GENERAL REQUIREMENTS

A. All work of this section shall be coordinated and provided by the single Building Management System (BMS/BAS) Contractor.

B. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.

C. The BMS shall perform all sequences of operation which may be listed on control drawings. Controls supplier shall provide all devices necessary to completely perform sequences whether such devices are explicitly shown on the drawings specified, or not shown or specified.

D. Where other Sections include a requirement for manufacturer equipment controllers (e.g. chillers, boilers, packaged units that are specified with packaged controls), this Section shall be responsible for provision of control components and software required to perform sequences of operation outlined that are in addition to the capabilities of the

controllers provided with the manufacturer equipment. Coordinate and integrate all equipment controllers.

E. Each component of the system, including the LANs and software, shall be in full compliance with ASHRAE Standard 135, commonly referred to as BACnet.

F. Provide the services of control manufacturer's representative to be on site during startup, testing and balancing procedures, detailed in Part 3 of this specification. Representative shall be part of manufacturer's service organization and shall be skilled in the adjustment and calibration of all control devices as well as being capable of modifying and checking system software.

1.6 ADMINISTRATIVE REQUIREMENTS

A. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades.

B. If the Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

C. Pre-installation Meeting: Conduct a pre-installation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

D. Scheduling: Coordinate with Owner and General Contractor. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.

1.7 COORDINATION

A. Coordinate locations of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate work under provisions of General Conditions and Division 1 as applicable.

C. Coordinate material delivery to comply with project schedule.

D. Coordinate conduit, and wiring installation with other trades to avoid conflicts.

E. Coordinate panel locations and installation with other trades to avoid conflicts and to provide power and other requirements.

1.8 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
   1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units,

transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.

2. Control System Software: Include technical data for operating system software, operator interface, color graphics, information on programmability and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data.

B. Shop Drawings: Submit shop drawings containing the following information for each control system:
1. System architecture diagram: Indicate programmable control unit locations, and trunk data conductors.
2. Schematic control diagrams: Submit diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
3. Floor plans: Show sizes and locations of components, horizontal routing and risers.
4. Points list: List connected data points, including connected control unit and input device.
5. Sequence of operation: Written detailed operational description of sequences
6. Schedule of dampers: Include size, leakage, pressure drop and other flow characteristics.
7. Schedule of valves: Including flow, pressure drop, valve coefficient (CV), shut-off head, maximum controllable differential pressure range and other flow characteristics.

C. Wiring Diagrams: Submit wiring diagrams, detailing wiring for power, signal, and control systems and differentiating clearly between manufacturers installed and field installed wiring.

D. Sample Covers: Submit samples of each type of space sensor cover for approval prior to ordering the covers.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owners name and registered with manufacturer.

1.9 RECORD DOCUMENTATION

A. General: Manuals shall be furnished as files in portable document format (PDF). One complete set of manuals shall be furnished before the contract is complete. The manuals shall include the name, address and telephone number of each subcontractor installing equipment and systems and of the local representative for each specific item of equipment and each system provided. A logically organized table of contents shall be included with dynamic links to view all data sheets.

B. Hardware Manual: The hardware manual shall describe the system and each piece of equipment provided.

C. Software Manual: The software manual shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module. The manual shall be oriented to programmers and shall describe calling requirements, data exchange requirements, data file requirements, and other information necessary to enable proper integration, loading, testing, and program execution.

D. Operations Manual: The Operations manual shall describe the operations of the complete system.

E. Maintenance Manual: The maintenance manual shall provide descriptions of maintenance for each piece of equipment, including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components.

F. Project Drawings: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors. Revise shop drawings to reflect actual installation and operating sequences.

1.10 QUALITY ASSURANCE

A. Products shall be standard manufacturer products having been in commercial or industrial use for at least one year prior to the bid date for this project. Products shall comply with the following as a minimum:
   1. NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
   2. NISTIR 6392 for digital system control components.
   3. ANSI/ASHRAE Standard 135-1995 for BACnet compatible system control components.
   4. Applicable provisions of NFPA code.
   5. Applicable provisions of NEC.

B. Designer Qualifications: Perform design of system software under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

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 certified and marked for intended use.

F. Comply with ASHRAE 135 for DDC system components.

1.11 PERFORMANCE REQUIREMENTS

A. Accuracy: Report values and maintain measured variables within tolerances as follows:
   1. Water Temperature: Plus or minus 1 deg F (0.5 deg C).
   2. Water Flow: Plus or minus 5 percent of full scale.
   3. Water Pressure: Plus or minus 2 percent of full scale.
   4. Space Temperature: Plus or minus 1 deg F (0.5 deg C).
   5. Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
   6. Outside Air Temperature: Plus or minus 2 deg F (1.0 deg C).
   7. Dew Point Temperature: Plus or minus 3 deg F (1.5 deg C).
   8. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
   9. Relative Humidity: Plus or minus 5 percent.

10. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
11. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
12. Airflow (Terminal): Plus or minus 10 percent of full scale.
13. Air Pressure (Space): Plus or minus 0.01-inch wg (2.5 Pa).
14. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).
15. Carbon Dioxide: Plus or minus 50 ppm.
16. Electrical: Plus or minus 5 percent of reading.

B. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.

1.12 WARRANTY

A. Correct defective Work within a five year period after Substantial Completion.

B. Provide five year manufacturer's warranty for field programmable micro-processor based units.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide operator workstation software, controller software, and custom application programming language, building controllers, programmable application controllers and application specific controllers from only one of the following manufacturers.
1. Alerton Inc
2. Automated Logic Corporation
3. Delta Controls
4. Distech Controls
5. Schneider Electric
6. KMC Controls
7. Honeywell International, Inc;
8. Johnson Controls, Inc;
9. Siemens AG, Building Technologies Division;

B. Other products specified herein (such as sensors, valves, dampers and actuators) need not be manufactured by the above manufacturers, unless otherwise noted.

2.2 SYSTEM DESCRIPTION

A. The system shall consist of a series of digital controllers interconnected by the LAN. One or more operator interface devices shall be connected to the LAN to provide access to the controllers for the purpose of receiving information or issuing commands. The controllers shall be located adjacent to the equipment they monitor or control and shall be sized for the task assigned to them. The system shall utilize distributed processing architecture and one controller shall be provided for each major piece of equipment controlled or monitored except that the equipment associated with the chiller plant and the heating plant shall be controlled from multiple controllers if necessary.

B. The communication network between building controllers shall be BACnet over Ethernet or BACnet over IP. The communication network between unitary or terminal unit

controllers shall be BACnet MS/TP over EIA-485. BACnet Point-To-Point may be used for communication between the network and modems, line drivers or other data communication equipment.

C. The BAS software shall be designed around the open standards of web technology. The BAS server shall communicate using the ASHRAE BACnet/IP protocol. The Server shall be accessed using a web browser. The web browser Graphical User Interface shall support Microsoft browsers, and Windows as well as non-Windows operating systems. No special software shall be required for the PC's/PDA's used to access the BAS via a web browser.

D. Input devices such as temperature sensors, humidity sensors, pressure sensors, motor current sensors, relays and other devices to sense or measure conditions of equipment or space, shall be provided as part of the system to meet the requirements of the sequences of operation.

E. Output devices such as valves, dampers, damper operators, relays, solenoids, transducers, or other devices to control equipment, shall be provided as part of the system to meet the requirements of the sequences of operation.

F. System Software:
1. Provide and install the software indicated in Part 2 of this specification. The database required for implementation shall be provided, including point description, alarm limit, calibration variable graphics, report, and point summaries.
2. The system described herein is a distributed processing system, which utilizes DDC to perform each logic and control decision and operation for each piece of equipment. An OID shall not be required to operate the system. Each item of large equipment, such as air handling units, boilers and PDDU units, shall be provided with a separate digital controller panel (DCP) with readout capability. Each equipment shall be controlled by a separate application-specific field controller (ASC).

G. Labeling: Provide a comprehensive labeling system for each wiring and component using the designations shown on the approved submittals.

H. Electrical Work: Provide the BAS power and control wiring required. This shall include power requirements for control panels, field controllers, sensors and other control devices. Provide transformers necessary to step down from the available voltage to the voltage required to operate the control system products and control devices.

I. Other Work: The work included under this Division shall include the drawings, specifications, submittals, equipment, labor, materials, technical supervision, transportation, training services, documentation, warranty, and other appurtenant work as required to furnish and install a fully operational system to monitor and control, set forth, in strict accordance with these specifications and subject to the terms and conditions of the Contract. An apparatus, appliance, material or work not shown on the drawings but mentioned in the specifications, or vice versa, or incidental accessories necessary to make the work entirely complete and ready for operation, even if not particularly specified, shall be furnished, delivered and installed by the Contractor without additional expense to the Owner.

J. Completion: It is the intention of the specifications and drawings to call for furnished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "provide and install complete and ready for use."

K. Omissions: Minor details not usually shown or specified but necessary for proper installation and operations shall be included, as if herein specified and/or shown.

2.3 OPERATOR INTERFACE

A. General:
1. PC Based Work Station shall reside on high speed network with building controllers and be connected to server for full access to all system information
2. Workstation, controllers, and control backbone shall communicate using BACnet protocol and addressing.

B. Personal Computer: PC compatible with sufficient memory and hard drive storage to support graphics, reports, and communication requirements. Furnish with the following minimum requirements:
1. Processor: Intel i5 4.0 GHz.
2. Hard Drive: 1 TB
3. Memory: 8 Gigabyte DDR4 SDRAM.
4. Mouse And keyboard.
5. Monitor: Minimum of 24 inch color, flat panel display.
6. Operating System: Windows 10
7. Printer: Furnish each operator workstation with color ink jet printer and associated cables. Printer capable of minimum of 14 pages per minute (PPM) operation and compatible with standard parallel or USB communications or network capable.

C. Laptop: PC compatible with sufficient memory and hard drive storage to support graphics, reports, and communication requirements. Furnish with the following minimum requirements:
1. Processor: Intel i5 [4.0] GHz.
2. Hard Drive: 1 TB
3. Memory: 8 Gigabyte DDR4 SDRAM.
4. Mouse: two-button optical type wireless.
5. Keyboard: 104 key.

2.4 GENERAL PURPOSE DIGITAL CONTROLLERS

A. General Purpose Digital Controllers shall be BTL listed.

B. Communication Speed: Controllers shall communicate using Ethernet or BACnet/IP using an unshielded twisted pair at the Data Link Layer.

C. General Specification: Each General Purpose Digital Controller shall be capable of stand-alone DDC operation utilizing its own minimum 16-bit processor, non-volatile flash memory, input/output, 10-bit A to D conversion, hardware clock/calendar, and voltage transient and lightning protection devices. Firmware revisions to the controller shall be made from the BAS server or remotely over the intranet or Internet. Controllers shall not require component changes to implement firmware revisions.

D. Self-Test Diagnostics: Each controller shall include self-test diagnostics, enabling the controller to automatically report malfunctions to the server.

E. Each General Purpose Multiple Application Digital Controller shall contain both software and firmware to perform full DDC Proportional, Integral, and Derivative (PID) control loops and programs.

F. Input/Output Processing:
1. Digital outputs shall be relays, each configured as normally open or normally closed. Each output shall have a manual Hand-Off-Auto switch to allow for override and a LED to indicate the operating mode of the output.
2. Universal inputs shall be Thermistor, RTD 0-10VDC, 0-20 mA, resistive and dry contact.
3. Analog output shall be electronic, voltage mode 0-10 VDC, current mode 4-20mA.

G. Power and Noise Immunity:
1. Maintain operation at 90 to 110 percent of nominal voltage rating.
2. Perform orderly shutdown below 80 percent of nominal voltage.
3. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

2.5 UNITARY OR TERMINAL DIGITAL CONTROLLERS

A. BACnet BIBBs: The Unitary Controllers shall use BACnet as the native communications protocol between controllers on the unitary controller network and shall be classified as AACs, ASCs, or SAs by the BACnet Testing Laboratory.

B. Communication Speed: The communication between unitary controllers shall be 38.4 Kbps, minimum, over EIA-485, using MS/TP architecture.

C. Sensor Support: Each unitary controller shall be able to support various types of zone temperature sensors, such as temperature sensor only, temperature sensor with built-in local override switch, and temperature sensor with built-in set point adjustment switch.

D. Each Unitary Controller for VAV application shall have a built-in air flow transducer for accurate air flow measurement in order to provide the pressure independent VAV operation, and an integral direct-coupled electronic actuator.

E. Visual Status: Each unitary controller and unitary controller interface shall have LED indication for visual status of communication, power, and each output.

F. Standalone Algorithm: In the event of a loss of communication, each Unitary Controller shall control from a stand-alone algorithm to maintain the assigned space temperature until communication with the unitary control module interface is restored.

G. Input/Output Processing:
1. Digital Outputs shall be relays, 24 Volts AC or DC maximum, having 3-amp maximum current. Each relay shall be configured as normally open or normally closed, and either dry contact or bussed.
2. Universal Inputs shall be Thermistor, RTD, dry contacts or 0-5VDC.

3. Enhanced Zone Sensor Input: The input shall provide one Thermistor input, one local setpoint adjustment, one timed local override switch, and one occupancy LED indicator.
4. Analog Output electronic, voltage made 0-10VDC or current mode 4-20mA or 3-wire floating.

2.6 INPUT/OUTPUT INTERFACE

A. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.

B. All Input/Output Points:
1. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
2. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.

C. Binary Inputs:
1. Allow monitoring of On/Off signals from remote devices.
2. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
3. Sense dry contact closure with power provided only by the controller.

D. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.

E. Analog Inputs:
1. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
2. Compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs:
1. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
2. Outputs provided with three position (On/Off/Auto) override switches.
3. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.

G. Analog Outputs:
1. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
2. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.

H. Tri State Outputs:
1. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
2. Limit the use of three point, floating devices to the following zone and terminal unit control applications:

a. VAV terminal units.
b. Duct mounted heating coils.
c. Zone dampers.
d. Radiation.

3. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

I. System Object Capacity:

1. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
2. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.7 BRIDGES AND ROUTERS

A. The controller network shall use BACnet as its native communication protocol. Network bridges and routers must be of a modular design to ensure reliability and system performance. Routers and bridges must be used between system LANs and between the system and third party devices requiring interfaces.

B. BACnet Router: The central system shall use the building's Local Area Network (LAN) for communication. The communication between the central server and the controllers shall be BACnet/IP. A router shall be provided as required to bridge BACnet/IP and the data link used between controllers (BACnet Ethernet and BACnet MS/TP). Proprietary networks and proprietary protocols are not acceptable. The BACnet routers shall utilize flash memory to allow firmware upgrades to be performed remotely.

C. Unitary Controller Router: A router shall be provided as required to bridge between the unitary controller network and the main controller network.

2.8 GATEWAYS

A. Bi-Directional Protocol Translator (BPT): The Building Automation System shall establish an interconnection, which appears to the operator to be seamless, between the building's electrical and/or mechanical subsystems, as well as other manufacturers' control systems as may be installed in the future. These systems shall be controlled, monitored, and programmed with the same programming language used for the other control modules.

1. The BPT shall be a microprocessor-based communication device to provide seamless, two-way translation between two or more standard or non-standard protocols.
2. The BPT shall be available for a variety of Data Link/Physical Layer configurations, including PTP (point-to-point) via EIA-232, MS/TP via EIA-485, and ARCNET.
3. In addition to BACnet, the BPT shall also support other protocols including Modbus, JBus and other protocols as specified herein for electrical/mechanical subsystems.
4. The BPT shall have at least three communications ports: One shall be for communication between native BACnet controllers residing on the controller network; the other two ports shall have the ability to be configured for different protocols.

5. The BPT shall provide full custom programmability of the data flowing between the networks, using the same graphic programming as specified herein. The system shall have the ability to create custom building control strategies using global data between networks.

2.9 PANELS

A. Cabinet: Each DDC Controller shall be enclosed in a field panel or equipment enclosure with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face. The field panel cabinet shall be general purpose utility enclosures with enameled finished face panel. Provide sufficient access for wire and conduit to enter the cabinet. Each of the field control panel locks for the project shall be keyed alike.
   1. Locations outdoors and/or in wet ambient conditions: Provide waterproof enclosure rated for operation at 32-122 degrees F.
   2. Locations in conditioned space: Provide dustproof enclosure

B. Each panel shall include the following:
   1. Receptacles: Provide a 20 ampere duplex receptacle inside or immediately adjacent to the field control panel.
   2. Master Disconnect Switch: Provide a master electrical power disconnect switch inside the field control panel to disconnect the external power to the cabinet for maintenance and repair. The disconnect switch shall not affect the duplex receptacle hereinbefore specified.
   3. Terminal Strips: Provide screw type terminal strips in the field control panel for the termination of field wiring. Lay out terminal strips in a neat and orderly fashion and label each termination. Wiring entering the panel shall be routed through the panel wire-ways in a neat and workmanlike manner, properly tied or laced and terminated.

2.10 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:
   1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
   2. Limit connected loads to 80 percent of rated capacity.
   3. Match DC power supply to current output and voltage requirements.
   4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
   5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
   6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
   7. Operational Ambient Conditions: 32 to 120 degrees F.
   8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD 810 for shock and vibration.
   9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:
   1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
   2. Minimum surge protection attributes:

a. Dielectric strength of 1000 volts minimum.
b. Response time of 10 nanoseconds or less.
c. Transverse mode noise attenuation of 65 dB or greater.
d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.11 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).
1. LAN Capacity: Not less than 60 stations or nodes.
2. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.
3. LAN Data Speed: Minimum 100 MBps
4. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.
5. Transmission Median: Fiber optic or single pair of solid 24 gage twisted, shielded copper cable.
6. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.
7. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels.

2.12 SYSTEM SOFTWARE

A. System Software Overview: The BAS Contractor shall provide the OID software required for efficient operation of the BAS specified herein. Software shall be modular in design to provide maximum flexibility, expandability, and to permit future revision of the system. The functionality described herein shall be regarded as a minimum. The system software shall include the following, as a minimum:
1. Complete database entry.
2. Configuration of the controller and operator workstation application programs to provide the sequence of operation indicated.
3. Dynamic color Graphics of each system.
4. Configuration of the reports and point summaries indicated.
5. Event/alarms comprised of Urgent Alarms, Alarms, and Messages as specified.

B. Graphical User Interface (GUI) Software
1. The GUI shall be a 32-bit full-featured software application compatible with Windows 10. The intent of the GUI is to provide an easy to use graphical OID that enables operators to manage their facilities on a day-to-day basis. The user may navigate within the system to check on environmental conditions, setpoints, schedules, etc. Using a mouse, it shall be possible to easily navigate through floor plans and different areas within a facility or multiple facilities. In addition, manual commands may be used to navigate directly to each point in the system and a tree structure shall show the control system hierarchy.

C. Workstation Applications Editors:
1. Database Creation and Modification. Changes shall be done utilizing standard procedures and while the system is on-line and operating. The system shall allow changes to be made either at the local site through a portable computer or at the central OID.

2. The system shall permit the operator to perform the following, as a minimum:
    a. Add and delete BACnet objects and points
    b. Assign BACnet Object/Device Instance numbers and Network numbers
    c. Modify point parameters, control sequences and programs
    d. Reconfigure application programs
    e. Create and/or modify graphics

2.13 CONTROLLER SOFTWARE

A. The system shall continuously perform DDC functions at the local control module in a stand alone mode. The operator shall be able to design and modify the control loops to meet the requirements of the system being operated. The operators shall use system-provided displays for tuning of PID loops. These displays shall include the past three input variable values, the setpoint for the loop, the sample interval and the results of the PID effects on the final output.

B. Each control module shall perform the following functions:
1. Identify and report alarm condition.
2. Execute each application programs indicated in the sequences of operation.
3. Execute DDC algorithms.
4. Trend and store data.
5. Maintain time-of-day schedules.

C. Software Integration: The programs should be integrated into a single working system and each of the above functions should be executed in real time and automatically when needed, such as to optimize the controlled equipment.

D. System Security: User access secured via user passwords and user names.

E. Object or Object Group Scheduling:
1. Weekly Schedules Based on Separate, Daily Schedules:
    a. Include start, stop, optimal stop, and night economizer.
    b. 10 events maximum per schedule.
    c. Start/stop times adjustable for each group object.
2. Exception Schedules:
    a. Based on any day of the year.
    b. Defined up to one year in advance.
    c. Automatically discarded and replaced with standard schedule for that day of the week upon execution.
3. Holiday or Special Schedules:
    a. Capability to define up to 99 schedules.
    b. Repeated annually.
    c. Length of each period is operator defined.

F. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

G. Alarms:
1. Binary object is set to alarm based on the operator specified state.
2. Analog object to have high/low alarm limits.
3. All alarming is capable of being automatically and manually disabled.
4. Alarm Reporting:
    a. Operator determines action to be taken for alarm event.

b. Alarms to be routed to appropriate workstation.

H. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

I. Sequencing: Application software based upon specified sequences of operation

J. PID Control Characteristics:
1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

K. Power Failure/Automatic Restart:
1. Power failures shall cause the control module to go into an orderly shutdown with no loss of program memory.
2. Upon resumption of power, the Control module shall automatically restart and printout the time and date of the power failure and restoration at the respective OID.
3. Prior to taking action, the controller shall look at the actual time-of-day and the programmed schedule for the controlled systems. If systems are operating, the restart program shall automatically restart affected field equipment. The operator shall be able to define an automatic power up time delay for each piece of equipment under control.

L. Staggered Start Application:
1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

M. Energy Calculations:
1. Accumulated instantaneous power or flow rates are converted to energy use data.
2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

N. Anti-Short Cycling:
1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

O. On-Off Control with Differential:
1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

P. Run-Time Totalization:
1. Totalize run-times for all binary input objects.

2. Provides operator with capability to assign high run-time alarm.

2.14 INPUT HARDWARE

A. Temperature Sensors: Vibration and corrosion resistant, for wall, immersion, or duct mounting as required.

1. General purpose temperature sensors
   a. Accuracy: +/-0.5 degrees F at calibration point.
2. Outside Air Temperature Sensors
   a. Description: Designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
   b. Accuracy: within +/- 1 degrees F in the range of -52 degrees F to 120 degrees F.
3. Room Temperature Sensors:
   a. Description: Steel cover plate with insulated back and security screws. Color per architect.
4. Room temperature sensors with slide switch
   a. Description: Construct for surface mounting. Provide setpoint reset slide switch with an adjustable temperature range.
   b. Accuracy: +/-0.5 degrees F in the range of 32 degrees F to 96 degrees F.
5. Room Temperature Sensors with Integral Digital Display:
   a. Description: Construct for surface mounting with four button keypad with the following capabilities:
      1) Indication of space temperature.
      2) Setpoint adjustment to accommodate room setpoint,
      3) Display and control fan operation status.
      4) Manual occupancy override and indication of occupancy status.
      5) Controller mode status.
6. Chilled water and condenser water sensors
   a. Accuracy: +/-0.25 degrees F in the range 30 degrees F to 70 degrees F.
7. Hot water temperature sensors
   a. Accuracy: +/-0.75 degrees F over the range of 50 degrees F to 250 degrees F.
8. Thermo wells:
   a. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure. Thermo wells and sensors shall be mounted in a threadolet or 1/2” NFT saddle and allow access to the sensor for repair or replacement. Thermo wells shall be constructed of 316 stainless steel.
9. Ceiling and Recessed Mount Temperature Sensors:
   a. Description: Ceiling-mounted sensor in a low-profile housing.
10. Temperature Averaging Elements
   a. Accuracy: +/- 1 degrees F.

b. Applications: Use on duct sensors for ductwork 10 sq ft or larger, where prone to stratification and for all mixed air and heating coil discharge sensors regardless of duct size.

11. Duct Mount Sensors
    a. Description: Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

B. Humidity Sensors: Vibration and corrosion resistant, for wall, immersion, or duct mounting as required.
1. Room Sensors
    a. Description With locking cover, matching room temperature sensors, span of 25% to 90% R.H.
    b. Accuracy: ± 3% of operating range, with linear output
2. Duct and Outside Air Sensors
    a. Description: With element guard and mounting plate, range of 0% to 100% R.H., with repeatable accurate readings from 10% to 90% R.H.
    b. Accuracy: ± 1% of operating range, with linear output

C. Differential Water Pressure Sensors
1. Manufacturers:
    a. Setra
    b. Mamac
    c. Automation Components Inc. (ACI)
    d. Greystone
2. Description: Industrial quality probe with pressure transducer designed to transmit a proportional 4 to 20 mA or 0-10VDC output in response to variation of differential pressure at water pressure sensing points. Pressure transmitters shall be selected with suitable range for expected input, temperature compensated, and constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input. A minimum of a NEMA 1 housing shall be provided for the transmitter. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines.
3. Transmitters shall be located in accessible local control panels wherever possible.
4. Accuracy: 1% of full scale, maintain up to 20 to 1 ratio turndown.

D. Differential Air Pressure Sensors
1. Manufacturers:
    a. Setra
    b. Mamac
    c. Automation Components Inc. (ACI)
    d. Greystone
2. Description: Air Static Pressure and Differential Pressure Sensors shall consist of a probe with pressure transducer designed to transmit a proportional 4 to 20 mA or 0-10VDC output in response to variation of differential pressure at air pressure sensing points. Pressure transmitters shall be selected with suitable range for expected input, temperature compensated, and constructed to

withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.

3. Accuracy: 2% of full scale with repeatability of 0.5%.
4. Range:
   a. Building Static Pressure Range: 0 inch to 0.25 inch wg.
   b. Duct Static Pressure Range: 0 inch to 5 inches wg.
   c. End of Line Primary Fan System Discharge Duct Static Pressure Range: 0 to 4 inches wg.
   d. Return Air and Outside Air Static Pressure Range: -2 to +2 inches wg.

E. Fluid Flow Monitoring
1. Electromagnetic type (Pipes 3" or larger)
   a. Manufacturer and model: Onicon F3500
   b. Description: Electromagnetic type with integral microprocessor-Based electronics, NEMA 4 enclosure, and 316L stainless steel wetted components, analog output signal. The meter shall have an accuracy of +/-1.0% from 2 to 20 ft/sec. Provide remote mounted LCD read-out panel or unit mounted.
2. Electromagnetic type (Pipes smaller than 3")
   a. Manufacturer and model: Onicon F3100
   b. Electromagnetic type with integral microprocessor-Based electronics, NEMA 4 enclosure, analog output signal. The meter shall have an accuracy of +/-0.4% ft/sec from 3.3 to 33 ft/sec. Provide remote mounted LCD read-out panel or unit mounted.

F. Status and Safety Switches
1. General Requirements and application: Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.
   a. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg. or current sensing switch, as indicated on the control diagrams.
   b. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 5 psig to 1.5 times the design pump operating pressure differential, or current sensing switch, as indicated on the control diagrams.
   c. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.
2. Current Sensing Switches
   a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
   b. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
3. Air Filter Status Switches

a. Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.
b. A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.
c. Provide appropriate scale range and differential adjustment for intended service.

4. Air Flow Switches
   a. Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
5. Air Pressure Safety Switches
   a. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
   b. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
6. Water Flow Switches
   a. Bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled-water applications, provide vapor-proof type.
7. Low Temperature Limit Switches
   a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
   b. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be serpentined across the leaving side of the coil surface in accordance with manufacturers recommended installation procedures.
   c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
8. Damper Position Indication
   a. Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

G. Vibration Switches: Designed to provide vibration protection for rotating machinery operating within the range of 120 to 60,000 rpm. Provide two limit set points, one set for the maximum allowable vibration (in/sec), and the other set for a percentage of that setting, tripping the alarm relay when that percentage is reached. Provide a built-in, adjustable time delay to prevent trips due to transient vibrations. Switch shall be wired for automatic remote reset and enclosed in water-tight housing.

H. Water Detectors: External tape-style sensor with contacts to connect to a monitoring system. Gold-plated probes and microchip technology for detection of conductive liquids. Weatherproof enclosure with LED indication if water detected.

I. Power Monitoring Devices:
1. Manufacturers:
   a. Veris Industries
2. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full

amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the BAS.

3. Current Transformer: A split core current transformer shall be provided to monitor motor amps.
   a. Operating frequency – 50 - 400 Hz.
   b. Insulation – 0.6 Kv class 10Kv BIL.
   c. UL recognized.
   d. Five amp secondary.
   e. Select current ration as appropriate for application.
4. Current Transducer: A current to voltage or current to mA transducer shall be provided. The current transducer shall include:
   a. 6X input over amp rating for AC inrushes of up to 120 amps.
   b. Manufactured to UL 1244.
   c. Accuracy: +.5%, Ripple +1%.
   d. Minimum load resistance 30kOhm.
   e. Input 0-20 Amps.
   f. Output 4-20 mA.
   g. Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).

J. Carbon Dioxide Sensors: Electronic, designed to monitor CO2 levels in HVAC systems for use in demand controlled ventilation systems according to ASHRAE Standard 62. Units shall have linear analog output of 0-10VDC/4-21mA, over a range of 0-3000 ppm of CO2. Units shall be furnished with a 5-year calibration guarantee.

K. Oxygen Sensor: Wall-mounted, single detectors, using solid-state zircon cell sensing, suitable over a temperature range of minus 32 to plus 1100 deg F (0 to 593 deg C), calibrated for 0 to 5 percent, with continuous or averaged reading, 4 to 20 mA output.

L. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment, flush mounting for finished areas (offices, entries, etc.), and wall mounted for storage areas, garages, shops, etc.

2.15 THERMOSTATS

A. General: Refer to control sequences and diagrams for application requirements. Manufacturer's standard thermostats shall meet the applicable requirements listed below, unless thermostat is specified in other sections.

B. Combination Thermostat and Fan Switches: Line-voltage thermostat with two-, three-, or four-position, push-button or lever-operated fan switch. Label switches "FAN ON-OFF," "FAN HIGH-LOW-OFF," or "FAN HIGH-MED-LOW-OFF." Provide unit for mounting on two-gang switch box. Separate heating and cooling setpoint with locking exposed setpoint adjustment. Automatic switching from heating to cooling.

C. Electric microcomputer-based room thermostats: 7-day programmable with automatic switching from heating to cooling, short-cycle protection, battery replacement without program loss, LCD display including room temperature, setpoint and mode.

D. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated mercury-switch type, with adjustable anticipation heater.

E. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch type, or equivalent solid-state type, with heat anticipator, integral manual on-off-auto selector switch. Thermostats that control electric heating loads directly shall be provided with off position on dial wired to break ungrounded conductors.

F. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature, with copper capillary and bulb, unless otherwise indicated.
1. Bulbs in water lines with separate wells of same material as bulb.
2. Bulbs in air ducts with flanges and shields.
3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit, adequately supported.
4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
5. On-Off Thermostat: With precision snap switches, with electrical ratings required by application.
6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

G. Fire-Protection Thermostats: UL listed with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, with the following:
1. Compliant with latest issue of NFPA 90A.
2. Reset: Manual
3. Dual-Temperature Thermostats: Automatic changeover from normal setting to lower unoccupied setting, with manual-reset lever to permit return to normal temperatures during unoccupied cycles, with automatic reset to normal during next cycle of operation.

H. Immersion Thermostats: Remote-bulb or bimetal rod-and-tube type, proportional acting with adjustable throttling range and adjustable set point.

I. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type, with adjustable set point in middle of range and adjustable throttling range, plug-in air gauge test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

J. Heating/Cooling Valve-Top Thermostats: Proportional acting for modulating flow, molded-rubber diaphragm, remote-bulb liquid-filled element, direct or reverse acting with minimum valve shutoff differential pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.16 TIME CLOCKS

A. Seven day programming switch timer with synchronous timing motor and seven day dial, continuously charged Ni-cad battery driven power failure 8 hour carry over and multiple switch trippers to control systems for minimum of two and maximum of eight signals per day with two normally open and two normally closed output switches.

B. Solid state programmable time control, 24 hour battery carry over, duty cycling.

2.17 CONTROL VALVES

A. General: All automatic control valves shall be factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of the piping system in which the valve is being installed, and be suitable for the system flow conditions and close against the differential pressures involved. Valves shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe open, closed, or in their last position. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the control manufacturer, and shall be guaranteed to meet the heating and cooling loads, as specified.

B. Sizing and application: Valves shall be globe, ball, and/or butterfly, as required by the specific application. Modulating water valves shall be sized per manufacturer's recommendations for the given application.
   1. Liquid Control Valves (water and glycol)
      a. Two-position service: Line size unless otherwise indicated.
      b. Two-way modulating service (non-pressure independent): Pressure drop shall be equal to the pressure drop through heat exchanger (load), 50 percent of the pressure difference between supply and return pipe mains, or 5 psi whichever is greater. Minimum Cv shall be calculated at 10 percent of design flow, with a coincident pressure differential equal to the system design pump head.
      c. Three-way modulating service: Pressure drop equal to the pressure drop through the coil exchanger (load), 5 psi maximum.
      d. For pressure independent valves, select for a differential pressure range of 5 to 50 psig.
      e. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
         1) Two-way: 150 percent of total system (pump) head.
         2) Three-way: 300 percent of pressure differential between ports A and B at design flow or 100 percent of total system (pump) head.

C. Ball Valves NPS 2 and Smaller:
   1. Description: Forged brass body with nickel plating, characterized stainless steel ball and trim, and Teflon seats and seals.
   2. Application: Characterized Ball valves shall be used for hot and condenser water applications, water terminal reheat coils, radiant panels, unit heaters, package air conditioning units, and fan coil units except those described hereinafter.
   3. Manufacturers:
      a. Belimo CCV
      b. Siemens
      c. Johnson Controls

D. Globe Pattern:
   1. Application: Modulating valves of the single-seat type with equal percentage flow characteristics shall be used for all AHU, ERU and special applications as indicated.
   2. Manufacturers:
      a. Belimo
      b. Siemens

c. Johnson Controls

3. Up to 2 inches (50 mm): Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
4. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and stainless steel disc.
5. Hydronic Systems:
   a. Rate for service pressure of 125 psig at 250 degrees F.
   b. Replaceable plugs and seats of stainless steel.
   c. Two way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two way valve operators to close valves against pump shut off head.
6. Steam Systems:
   a. Rate for service pressure of 125 psig at 250 degrees F.
   b. Replaceable plugs and seats of stainless steel. Pressure drop across any steam valve at maximum flow shall be as shown on the Drawings.
   c. Valves shall have modified linear characteristics.

E. Butterfly Pattern:
1. Application: High Performance Butterfly valves shall be acceptable for modulating large flow applications greater than modulating plug valves, and for all two-position, open/close applications. In-line and/or three-way butterfly valves shall be heavy-duty pattern with a body rating comparable to the pipe rating, replaceable lining suitable for temperature of system, and a stainless steel vane.
2. Sizing: Valves for modulating service shall be sized and travel limited to 50 degrees of full open. Valves for isolation service shall be the same as the pipe. Valves in the closed position shall be bubble-tight.
3. Manufacturers:
   a. Nibco, Inc.
   b. Crane Co.
   c. Grinnell
   d. Hammond Valve
   e. Milwaukee Valve Co.
   f. Bray International
4. Lug type: Bi-directional dead end service without downstream flange.
   a. Body: Carbon steel, cast iron, ductile Iron or stainless steel.
   b. Seat: Metal or reinforced PTFE.
   c. Offset stem: Stainless steel.
   d. Disc: 316 Stainless Steel

2.18 DAMPERS

A. General: The BMS Contractor shall furnish all automatic dampers unless provided as standard from equipment manufacturer. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the Drawings.

B. Sizing and Application: All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear. All dampers used for two-position, open/close control and mixing boxes shall be parallel blade type arranged for normally open or closed operation, as required.

C. Airfoil Blade Dampers
   1. General: Double skin construction with linkage out of the air stream
   2. Manufacturers:
      a. Johnson Controls D-7250 D-1250 or D-1300
      b. Ruskin CD50
      c. Vent Products 5650.
      d. Tamco
   3. Application: whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g.

D. One-Piece Rolled Blade Damper
   1. Manufacturers:
      a. Johnson Controls D-1600
      b. Ruskin CD36
      c. Vent Products 5800
      d. Tamco
   2. Performance: Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Std. 500.
   3. Construction:
      a. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage, 0.1046 inch.
      b. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 22 gage, 0.0299 inch, attached to minimum 1/2 inch shafts with set screws.
      c. Blade Seals: Synthetic elastomeric inflatable mechanically attached, field replaceable.
      d. Jamb Seals: Spring stainless steel.
      e. Shaft Bearings: Oil impregnated sintered bronze.
      f. Linkage Bearings: Oil impregnated sintered bronze.
   4. Application: face velocities of 1500 FPM or below.

2.19 ACTUATORS

A. General: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action over the entire operating range. Provide proportional or two-position type as indicated in the sequence of operation, with current limiting circuitry or microprocessor overload protection.

B. Manufacturers:
   1. Johnson Controls
   2. Honeywell
   3. Belimo
   4. Siemens

C. Electronic Damper Actuators
   1. Modulating and two-position actuators shall be provided as required by the sequence of operations and as indicated on drawings. Damper sections shall be sized based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of

the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction and a gear release to allow manual positioning.

2. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
3. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.
4. Electronic damper actuators shall be direct shaft mount.

D. Electronic Valve Actuators:

1. Modulating and two-position actuators shall be provided as required by the sequence of operations. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. The valve actuator shall be sized Based on valve manufacturer's recommendations for flow and pressure differential. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves, as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.
2. Modulating Actuators shall accept 24 VAC or VDC and 120 VAC power supply and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal, and may be used to parallel other actuators and provide true position indication. The feedback signal of each valve actuator (except terminal valves) shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
3. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated pump or heat exchanger.

2.20 WIRE, CABLE AND NETWORK ACCESSORIES

A. Exposed cables installed in air plenums shall be specifically listed for air plenum use. (See specifications for specific wire and cable installation requirements.)

B. Cables, both fiber and copper, shall be as recommended by the manufacturer of the BAS, and shall be as required to support the specified LAN BACnet transmission type.

C. Network Repeater: Provide network repeaters as required to isolate and boost RS-485 signals. Provide power connection and NEMA enclosure as required.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2 INSTALLATION

A. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

B. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

C. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation.

D. Provide with 120v AC, 15 amp dedicated emergency power circuit to each programmable control unit.

E. Provide conduit and electrical wiring in accordance with Section 26. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

F. Combination fire Smoke dampers shall be installed by division 23, powered by division 26, interconnecting control wiring between duct mounted smoke detector and fire/smoke damper by BMS contractor, alarm points, status/position, shut down of unit and notification by BMS contractor.

G. Furnish and install all access doors.

H. BMS Wiring
   1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
   2. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.
   3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or

conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

4. Class 2 Wiring
   a. All exposed Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
   b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
   c. The use of plenum rated cable, not in conduit, in areas such as drop ceilings and wall cavities is acceptable.
   d. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
5. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

I. BMS Line Voltage Power Source
1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 26.
2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
3. DDC terminal unit controllers may use AC power from motor power circuits.

J. BMS Raceway
1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 3/4".
2. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
3. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

K. Penetrations
1. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

L. BMS Identification Standards
1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.
   a. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

M. BMS Panel Installation

1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

3.3 COMMISSIONING

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. The Contractor shall provide the services of a factory authorized service representative to assist an independent commissioning agent to start up the BAS, and to commission each component included in the BAS.

C. Controls and Safeties: Test, and set each of the digital and analog sensing and actuating devices. Test each instrumentation device by making a comparison between the central computer or field control panel display and the reading at the device, using an instrument traceable to the National Bureau of Standards, which shall be at least twice as accurate as the device to be tested. Record the measured value and displayed value for each device in the Commissioning Report.

D. Operational Tests: The Contractor shall conduct an operational test of each system and subsystem, including each of the associated field control panels, components, and field devices, to verify the proper sequence of operation and the actual performance of the installed BAS subsystem.

E. Documentation: Provide written documentation of the system commissioning and performance verification processes described above, including an itemized inspection and validation report complete with dates and second test results, and a performance test report for each system and each Sequence of Operation.

3.4 DEMONSTRATION AND INSTRUCTIONS

A. General: The contractor shall demonstrate the operation of the BAS hardware, software, and each of the related components, systems and subsystems to the satisfaction of the Owner. The Contractor shall schedule the demonstration with the Owner's representative at least 2 weeks in advance of the proposed demonstration. Demonstration shall not be scheduled until each of the hardware and software submittals, and the Commissioning Test Report are received and approved. If the work fails to conform to Contract specifications, scheduling of additional site visits by the Contractor for re-demonstration is required.

B. Personnel and Equipment: The Contractor shall supply the required personnel and equipment for the demonstration, including, but not limited to, instruments, ladders, paper, etc. The contractor-supplied personnel shall be competent with and knowledgeable of the project-specific hardware, software, and the HVAC systems. Complete training documentation and a complete copy of the BAS submittals shall be on file at the job site.

C. Physical Demonstration of Response to System Conditions: System acceptance shall include demonstrations that each of the components function properly by actual response to system conditions that may be encountered. The Contractor shall furnish the materials such as sources of temporary heating and cooling necessary to cause the system components to go through the required sequences. Computer simulations of possible operating conditions are not acceptable for demonstration of system performance. Proposed methods of demonstrating component operation shall be submitted to the Owner. Representatives of Owner will also witness the tests.

D. Orientation and training: Provide services of qualified technical personnel for three 6-hour days at project site to instruct Owner's personnel in operation and maintenance of the installed BAS.

3.5 ACCEPTANCE

A. Upon completion of the installation and commissioning of the systems, the contractor shall notify the owner's representative in writing, together with a copy of the commissioning report, that the system is complete and ready for acceptance testing. The owner's representative shall schedule a starting day for system acceptance testing. The contractor shall demonstrate calibration, testing, and adjusting of points or systems selected by the owner's representative. After an adequate sampling of points and sequences have been verified to satisfy the owner's representative that the system is performing in accordance with the contract documents, the system shall be accepted and the warranty period shall begin.

3.6 MAINTENANCE

A. See Section 01 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

C. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

D. Provide complete service of systems, including service calls to inspect, calibrate, and adjust controls, and submit written reports.

END OF SECTION

SECTION 232300 - REFRIGERANT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Check valves.

G. Pressure regulators.

H. Pressure relief valves.

I. Filter-driers.

J. Solenoid valves.

K. Expansion valves.

L. Receivers.

M. Flexible connections.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Division 07 - Thermal and Moisture Protection

C. Division 08 - Openings

D. Division 09 - Finishes

E. Division 23 - Mechanical

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers

B. AHRI 710 - Performance Rating of Liquid-Line Driers.

C. AHRI 730 (I-P) - Flow Capacity Rating of Suction-Line Filters and Suction-Line Filter-Driers

D. AHRI 750 - Thermostatic Refrigerant Expansion Valves

E. AHRI 760 - Performance Rating of Solenoid Valves for Use With Volatile Refrigerants

F. ASHRAE Std 15 - Safety Standard for Refrigeration Systems

G. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants

H. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels

I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications

J. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

K. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes

L. ASME B31.5 - Refrigeration Piping and Heat Transfer Components

M. ASME B31.9 - Building Services Piping

N. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

O. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

P. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

Q. ASTM B88 - Standard Specification for Seamless Copper Water Tube

R. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

S. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers

T. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

U. AWS D1.1 - Structural Welding Code - Steel

V. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

W. UL 429 - Electrically Operated Valves; Current Edition, Including All Revisions.

1.4 SYSTEM DESCRIPTION –

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:
1. Use line size liquid indicators in main liquid line leaving condenser.
2. If receiver is provided, install in liquid line leaving receiver.
3. Use line size on leaving side of liquid solenoid valves.

D. Valves:
1. Use service valves on suction and discharge of compressors.
2. Use service valves on suction and discharge of evaporators.
3. Use gage taps at compressor inlet and outlet.
4. Use gage taps at hot gas bypass regulators, inlet and outlet.
5. Use check valves on compressor discharge.
6. Use check valves on condenser liquid lines on multiple condenser systems.

E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F. Strainers:
1. Use line size strainer upstream of each automatic valve.
2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.
3. Use shut-off valve on each side of strainer.

G. Pressure Relief Valves: Use on ASME receivers and pipe to outdoors.

H. Filter-Driers:
1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
2. [Use a filter-drier on suction line just ahead of compressor.]
3. [Use sealed filter-driers in lines smaller than 1/2 inch outside diameter.]
4. [Use sealed filter-driers in low temperature systems.]
5. [Use sealed filter-driers in systems utilizing hermetic compressors.]
6. [Use replaceable core filter-driers in lines of 1/2 inch outside diameter or greater.]

I. Solenoid Valves:
1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.
2. Use in liquid line of single or multiple evaporator systems.
3. Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

J. Receivers:
1. Use on systems 10 tons and larger, sized to accommodate pump down charge.
2. Use on systems with long piping runs.

K. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.5 SUBMITTALS

A. See Division 01 - General Requirements.

B. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturers catalog data including load capacity.

C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

D. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, equivalent piping lengths and sizes.

E. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

F. Test Reports: Indicate results of leak test, acid test.

G. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

H. Submit welders certification of compliance with ASME BPVC-IX.

I. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

J. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Division 01 - General Requirements
2. Extra Filter-Dryer Cartridges: One of each type and size.
3. Refrigeration Oil Test Kits: One, each containing everything required to conduct one test.
4. Extra Refrigerant: One container of refrigerant, five pound size.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall have the following responsibilities:
1. Note: Pipe sizes and routing on drawings are shown for reference only and based on listed manufacturer's equipment only.
2. Determine coordination and final routing, sizes and locations of all system piping and components.
3. Coordinate system requirements, valves, driers, and accessories for complete system with equipment manufacturer.
4. Calculate total system volume and refrigerant charge required for proper operation.
5. Provide installation instructions, drawings and field supervision to assure proper installation and performance.

1.7 QUALITY ASSURANCE

A. Designer Qualifications: Design piping system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

C. Welders Certification: In accordance with ASME BPVC-IX.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.2 PIPING

A. Copper Tube: ASTM B280, Type ACR hard drawn or annealed.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.3 REFRIGERANT

A. Refrigerant: Based on equipment schedules

2.4 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
   1. Henry Technologies
   2. Parker Hannifin/Refrigeration and Air Conditioning
   3. Sporlan, a Division of Parker Hannifin
   4. Substitutions: See Division 01 - General Requirements.

B. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.5 VALVES

A. Manufacturers:
   1. Hansen Technologies Corporation
   2. Henry Technologies

3. Flomatic Valves
4. Substitutions: See Division 01 - General Requirements.

B. Diaphragm Packless Valves:
1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F .

C. Packed Angle Valves:
1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F .

D. Ball Valves:
1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F

E. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.6 STRAINERS

A. Manufacturers:
1. Hansen Technologies Corporation
2. Parker Hannifin/Refrigeration and Air Conditioning
3. Sporlan, a Division of Parker Hannifin
4. Substitutions: See Division 01 - General Requirements.

B. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.7 CHECK VALVES

A. Manufacturers:
1. Hansen Technologies Corporation
2. Parker Hannifin/Refrigeration and Air Conditioning
3. Sporlan, a Division of Parker Hannifin
4. Substitutions: See Division 01 - General Requirements.

B. Globe Type:
1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.

C. Straight Through Type:
1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

2.8 PRESSURE REGULATORS

A. Manufacturers:
1. Hansen Technologies Corporation
2. Parker Hannifin/Refrigeration and Air Conditioning
3. Sporlan, a Division of Parker Hannifin
4. Substitutions: See Division 01 - General Requirements.

B. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi range, for maximum working pressure of 450 psi.

2.9 PRESSURE RELIEF VALVES

A. Manufacturers:
1. Hansen Technologies Corporation
2. Henry Technologies
3. Sherwood Valve/Harsco Corporation
4. Substitutions: See Division 01 - General Requirements.

B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi .

2.10 FILTER-DRIERS

A. Manufacturers:
1. Flow Controls Division of Emerson Electric
2. Parker Hannifin/Refrigeration and Air Conditioning
3. Sporlan, a Division of Parker Hannifin
4. Substitutions: See Division 01 - General Requirements.

B. Performance:
1. Flow Capacity - Liquid Line: Size per approved equipment capacity, rated in accordance with AHRI 710.
2. Flow Capacity - Suction Line: , Size per approved equipment capacity rated in accordance with AHRI 730 (I-P).
3. Water Capacity: Size per approved equipment capacity, rated in accordance with AHRI 710.
4. Water Capacity: As indicated in schedule, rated in accordance with AHRI 710.
5. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
6. Design Working Pressure: 350 psi, minimum.

C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

D. Construction: UL listed.
1. Replaceable Core Type: Steel shell with removable cap.
2. Sealed Type: Copper shell.
3. Connections: As specified for applicable pipe type.

2.11 SOLENOID VALVES

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric
   2. Parker Hannifin/Refrigeration and Air Conditioning
   3. Sporlan, a Division of Parker Hannifin
   4. Substitutions: See Division 01 - General Requirements.

B. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.

C. Coil Assembly: UL 429, UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

2.12 EXPANSION VALVES

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric
   2. Parker Hannifin/Refrigeration and Air Conditioning
   3. Sporlan, a Division of Parker Hannifin
   4. Substitutions: See Division 01 - General Requirements.

B. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.13 ELECTRONIC EXPANSION VALVES

A. Manufacturers:
   1. Flomatic Valves
   2. Parker Hannifin/Refrigeration and Air Conditioning
   3. Sporlan, a Division of Parker Hannifin
   4. Substitutions: See Division 01 - General Requirements.

B. Valve:
   1. Brass body with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.
   2. Capacity: compatible with compressor size it serves

C. Evaporation Control System:
   1. Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, preselection allowance for electrical defrost and hot gas bypass.

D. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

2.14 RECEIVERS

A. Manufacturers:
1. Henry Technologies
2. Parker Hannifin/Refrigeration and Air Conditioning
3. Sherwood Valve/Harsco Corporation.
4. Substitutions: See Division 01 - General Requirements.

B. Internal Diameter 6 inch (150 mm) and Smaller:
1. AHRI 495, UL listed, steel, brazed; 400 psi maximum pressure rating, with tappings for inlet, outlet, and pressure relief valve.

C. Internal Diameter Over 6 inch :
1. AHRI 495, welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; 400 psi with tappings for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

2.15 FLEXIBLE CONNECTORS

A. Manufacturers:
1. Circuit Hydraulics, Ltd
2. Flexicraft Industries
3. Penflex
4. Substitutions: See Division 01 - General Requirements.

B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with piping parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08.

J. Flood piping system with nitrogen when brazing.

K. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

L. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09- Finishes.

M. Insulate piping and equipment; refer to Section and Section 23 0700.

N. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

O. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

P. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

Q. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

R. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

S. Fully charge completed system with refrigerant after testing.

T. Provide electrical connection to solenoid valves. Refer to Division 26.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to maximum allowable working pressure. Pressure shall hold for a minimum of 24 hours with no leakage allowed.

END OF SECTION

SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Duct Materials.

B. Duct Liner

C. Non-Insulated Flexible ducts.

D. Insulated flexible ducts.

E. Single wall spiral round ducts.

F. Single wall spiral flat oval ducts.

G. Double wall spiral insulated round ducts.

H. Double wall spiral insulated flat oval ducts.

I. Transverse duct connection system.

J. Chemical Resistant Duct

K. Kitchen hood exhaust ductwork fabrication.

1.2 RELATED SECTIONS

1. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.3 REFERENCES

A. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
4. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
5. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
6. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

7. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
8. A1011/A1011M-07 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
9. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
10. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
11. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
12. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

C. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - Fibrous Glass Duct Construction Standards.
2. SMACNA - HVAC Air Duct Leakage Test Manual.
3. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:
1. UL 181 - Factory-Made Air Ducts and Connectors.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" beef up duct hanger and support in this section.

C. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS

A. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:

1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
3. Fittings.
4. Reinforcing details and spacing.
5. Seam and joint construction details.
6. Penetrations through fire rated and other walls.
7. Terminal unit, coil, and humidifier installations.
8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

B. Product Data: Submit data for duct materials, duct liner, duct connectors .

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A, NFPA 90B and NFPA 96 standards as applicable.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealant.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 (zinc coating of in conformance with ASTM A90/A90M.

B. Steel Ducts: ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.

C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength. Mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

D. Stainless Steel Ducts: ASTM A480/A480M, Type [304.] [316.] Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article

E. Fasteners: Rivets, bolts, or sheet metal screws.

F. Hanger Rod: ASTM A36/A36M; steel , galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 DUCT LINER

A. Fibrous-Glass Duct Liner
   1. Manufacturers:
      a. CertainTeed Corporation; Insulation Group.
      b. Johns Manville.
      c. Knauf Insulation.
      d. Owens Corning.
   2. Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
      a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Elastomeric Duct Liner:
   1. Manufacturers:
      a. Aeroflex USA Inc.
      b. Armacell LLC
      c. K-Flex
   2. Description: Elastomeric foam duct liner, integral EPA registered antimicrobial agent, complying with NFPA 90A or NFPA 90B.
   3. Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
    a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 NON-INSULATED FLEXIBLE DUCTS

A. Manufacturers:
   1. Thermaflex Technaflex
   2. Tuttle + Bailey
   3. Flexmaster

B. Product Description: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helical-wound spring steel wire.
   1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
   2. Maximum Velocity: 4000 fpm.
   3. Temperature Range: -20 degrees F to 210 degrees F.

2.4 INSULATED FLEXIBLE DUCTS

A. Manufacturers:
   1. Thermaflex
   2. Technaflex
   3. Tuttle + Bailey
   4. Flexmaster

B. Product Description: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helical wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.
   1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
   2. Maximum Velocity: 4000 fpm.
   3. Temperature Range: -20 degrees F to 210 degrees F.
   4. Thermal Resistance: 6square feet-hour-degree F per BTU.
   5. Vapor Barrier Permeance: 0.05 perm per ASRM E96, Procedure A

2.5 SEALANTS AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
   1. General: Brush-on, water-resistant, mold and mildew resistant, indoor and outdoor use, compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
   2. Solids Content: Minimum 65 percent.
   3. Shore A Hardness: Minimum 20.
   4. VOC: Maximum 75 g/L (less water).
   5. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

C. Flanged Joint Sealant: Comply with ASTM C 920.
   1. General: Single-component, acid-curing, silicone, elastomeric.
   2. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.

2.6 SINGLE WALL SPIRAL ROUND DUCTS

A. Manufacturers include, but are not limited to:
1. McGill AirFlow Corporation
2. Semco Incorporated
3. Tangent Air Corp
4. Spiral Mfg. Co., Inc.

B. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

C. Construct ducts and fittings gauge per the latest edition of SMACNA.

2.7 SINGLE WALL SPIRAL FLAT OVAL DUCTS

A. Manufacturers include, but are not limited to:
1. McGill AirFlow Corporation
2. Semco Incorporated
3. Tangent Air Corp
4. Spiral Mfg. Co., Inc.

B. Product Description: Machine made from round spiral lockseam duct constructed of galvanized steel; rated for 10 inches wg pressure.

C. Joints: Either fully welded or bolted flange with gasket material in accordance with manufacturer's recommendations.

D. Construct duct with the following minimum gauges:

Major Axis Dimension	Gauge
7 inches to 24 inches	24
25 inches to 48 inches	22
50 inches to 70 inches	20
72 inches to 82 inches	18
84 inches and larger	16

E. Construct fittings with the following minimum gauges:

Major Axis Fitting Dimension	Gauge
7 inches to 36 inches	20
37 inches to 60 inches	18
62 inches and larger	16

2.8 DOUBLE WALL SPIRAL INSULATED ROUND DUCTS

A. Manufacturers include, but are not limited to:
   1. McGill AirFlow Corporation
   2. Semco Incorporated
   3. Tangent Air Corp
   4. Spiral Mfg. Co., Inc.

B. Product Description: Machine made from round spiral lock seam duct with light reinforcing corrugations, galvanized steel outer wall, [1] [2] [3] inch thick glass fiber insulation, perforated galvanized steel inner wall; fittings manufactured with perforated inner wall.

C. Construct round duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

D. Construct round fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

2.9 DOUBLE WALL SPIRAL INSULATED FLAT OVAL DUCTS

A. Manufacturers include, but are not limited to:
   1. McGill AirFlow Corporation
   2. Semco Incorporated
   3. Tangent Air Corp
   4. Spiral Mfg. Co., Inc.
   5. United McGill

B. Product Description: Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, [1] [2] [3] inch thick glass fiber insulation, perforated galvanized steel inner wall; fittings manufactured with perforated inner wall.

C. Construct flat oval duct with the following minimum gauges:

Major Axis Dimension	Gauge
7 inches to 24 inches	24
25 inches to 48 inches	22
50 inches to 70 inches	20
72 inches to 82 inches	18
84 inches and larger	16

D. Construct flat oval fittings with the following minimum gauges:

Major Axis Fitting Dimension	Gauge
7 inches to 36 inches	20
37 inches to 60 inches	18
62 inches and larger	16

2.10 TRANSVERSE DUCT CONNECTION SYSTEM

A. Manufacturers:
1. United McGill
2. Semco
3. ACME
4. Nufab

B. Product Description: [SMACNA "E" rated] [SMACNA "F" rated] [or] [SMACNA "J" rated] rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.11 DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible . Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards). Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. TDC connections on all ductwork where any dimension exceeds 12 inches. Slip and drive connection acceptable on duct sizes less than 12” x 12”.

D. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide [airfoil] turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

G. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

H. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems.
   1. Sealants, Mastics: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.
   2. Do not provide sealing products not bearing UL approval markings.

2.12 KITCHEN HOOD EXHAUST DUCTWORK FABRICATION

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.

B. Exposed Kitchen Hood Exhaust Ducts: Construct of stainless steel ASTM ASTM A240/A240M OR ASTM 666, type 316using continuous external welded joints.

C. Concealed Kitchen Hood Exhaust Ducts: Construct of 16 gage carbon steel or 18 gage stainless steel ASTM ASTM A240/A240M OR ASTM 666, type 316 using continuous external welded joints.

D. Grease Duct: Provide factory built commercial grease ducts labeled and listed in accordance with UL 1978.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. General:
   1. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
   2. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
   3. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
   4. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8inch and smaller.
   5. Install duct hangers and supports in accordance with Section 23 05 29.

6. Use double nuts and lock washers on threaded rod supports.
7. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
8. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
9. Do not route ducts through transformer vaults or electrical equipment rooms and enclosures.
10. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
11. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23, Air Duct Accessories for fire and smoke dampers.

B. Flexible ductwork
1. When located above ceilings, support flexible duct from above; flexible duct shall not touch the ceiling.
2. Minimize kinks and sags
3. Flexible duct shall be located only where concealed and accessible.
4. Non-insulated flexible ductwork: Provide when the metal ductwork connected to is not insulated.
5. Insulated flexible ductwork: Provide when the metal ductwork connected to is insulated. R-value of flexible ductwork insulation shall meet or exceed the R-value of the metal ductwork insulation.
6. Elbow supports: Provide above flexible ductwork connections to ceiling diffusers. Use cable ties as indicated in the manufacturer's installation instructions.
7. Connections to rigid ductwork: Provide both a drawband and two layers of duct tape lapped approximately 25% at each connection of flexible ductwork to rigid ductwork. Drawbands shall be the non-metallic type listed and labeled in accordance with UL 181B. Duct tape shall be listed and labeled in accordance with UL 181B.

C. Kitchen Hood Exhaust Ducts
1. Install kitchen range hoods in accordance with NFPA 96. Refer to Section 11 40 00.
2. Install residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out.
3. Kitchen hood exhaust ducts: Use stainless steel for ductwork exposed to view and stainless steel or carbon steel where ducts are concealed.

D. For outdoor ductwork, protect ductwork, ductwork supports, linings and coverings from weather.

3.3 DUCT SEALING

A. Duct Seal Level Description

Seal Level	Sealing Requirements*
A	All transverse joints, longitudinal seams, and duct wall penetrations. Pressure sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL-181A or UL0181B by an

	independent testing laboratory and the tape is used in accordance with that certification
B	All transverse joints, longitudinal seams. Pressure sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL-181A or UL0181B by an independent testing laboratory and the tape is used in accordance with that certification.
C	Transverse joints only.
Notes: Longitudinal seams are joints oriented in the direction of flow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod, or wire. Spiral lock seams in a round or flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to spin-ins, taps, and other branch connections, access door frames and jambs, duct connections to equipment, etc.	

B. Minimum Duct Seal Levels

Duct Type				
Duct Location	Supply		Exhaust	Return
	2-in. or less (1)	Greater than 2-in. (1)		
Outdoor	A	A	C	A
Unconditioned Space (2)	B	A	C	B
Conditioned Space	C	B	B	C
Notes: Duct design static pressure classification Includes indirectly conditioned spaces such as return air plenums				

3.4 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect air terminal units to supply ducts directly or with five foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.5 CONCEALED GREASE DUCT TESTING

A. Prior to concealing, wrapping, or insulating grease ductwork, or placing grease duct in service, perform leakage test in accordance with ICC IMC, in presence of authority having jurisdiction.

B. Perform light test by pulling minimum 100 W light through duct and observing for light leaks at duct joints.

C. Test complete extent of duct installed, including joint at which duct connects to exhaust hood.

3.6 CLEANING

1. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Duct cleaning is required if test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems." do not meet the following criteria:

1. Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

C. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

D. Clean duct systems with high power vacuum machines. Protect equipment with potential to be harmed by excessive dirt with filters, or bypass during cleaning. Install access openings into ductwork for cleaning purposes.

3.7 DUCTWORK LEAKAGE TESTING

A. The following ductwork systems shall be pressure/leakage tested:

1. All ductwork to be concealed in a sheetrock, concrete block or other permanent chase shall be pressure tested before ductwork is concealed.
2. [2012 IECC REQUIREMENTS]
   a. [All][Representative sections totaling no less than 25% of] ductwork systems listed below that are constructed and installed for 3” w.c. or more (positive or negative).]
3. [CODE PLUS CHOICES]
   a. [All supply air ductwork from outlet of each AHU to inlet of each VAV box]
   b. [All supply air ductwork from outlet of each ahu to the inlet of each diffuser.]
   c. [All return air and exhaust air ductwork mains.]
4. For ductwork leakage testing: “Ductwork main” shall be defined as all ductwork serving more than one grille or diffuser.
5. All ductwork outside of the building insulation envelope shall be pressure tested.

B. Testing shall conform to the following:

1. Test static pressure must be the lower of 125% of the external static pressure of the air moving equipment or the construction static pressure class of the ductwork.
2. Test in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Maximum Allowable Leakage shall be in accordance with Duct Pressure Class rating listed below and Leakage Class listed here-in.
3. For Ductwork Pressure Class 3” w.c: Leakage Class shall be 8.
4. For Ductwork Pressure Class 2” w.c or less: Leakage Class shall be 16.

5. Testing shall occur after ductwork has been cleaned, but before duct insulation is applied or ductwork is concealed.

C. Duct Leakage Test Report shall include:
1. Date of test.
2. Name of company and person conducting the test.
3. Name of company and person witnessing the test.
4. Description of ductwork tested. Provide drawings to indicate section of ductwork being tested. Labeling on the drawings shall correspond to labeling in the report.
5. Surface area (square feet) of section of ductwork being tested.
6. Duct design operating pressure (inches w.c.)
7. P = Duct design test static pressure (inches w.c.)
8. Duct capacity, air flow
9. CL= Specified Leakage Class.
10. F = Leakage factor (CFM / 100 sf of duct area)
11. Maximum allowable leakage (CFM)
12. Test apparatus
    a. Blower
    b. Orifice tube size
    c. Orifice size
    d. Calibrated
13. Test orifice differential pressure (inches w.c.)

3.8 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply (System with Cooling Coils)	Galvanized Steel, Aluminum,
Chemical Resistant Duct	PVC Duct
Return and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum
Kitchen Hood Exhaust	Steel, Stainless Steel
Dishwasher Exhaust	Stainless Steel, Aluminum
Outside Air Intake	Galvanized Steel
Emergency Generation Ventilation	Galvanized Steel

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Supply Ductwork (upstream of VAV boxes terminal units and/or final balancing damper)	3 inch wg
Supply Ductwork (downstream of VAV boxes and terminal units)	[1] [_____] inch wg regardless of velocity.
Buried Supply or Return	[3 inch wg]

Return and Relief	[2 inch wg] regardless of velocity.
General Exhaust	[1 inch wg] regardless of velocity.
Dishwasher Exhaust	[1 inch wg] [2 inch wg]
Fume Hood Exhaust	[2 inch wg]
All Others Not Identified	1.5x maximum anticipated system pressure

C. Ductwork Liner Schedule:

AIR SYSTEM	THICKNESS
10 ft downstream of VAV box	1 inch
10 ft upstream / downstream of fan coil unit	1 inch
First 10 ft of supply and return/ exhaust from AHU/ERV/DOAS	1 inch
Transfer air ducts	1 inch

END OF SECTION

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Back-draft dampers.

B. Combination fire-and-smoke dampers.

C. Duct access doors.

D. Dynamic fire dampers.

E. Smoke dampers.

F. Volume control dampers.

G. Flexible duct connections.

H. Duct test holes.

1.2 RELATED SECTIONS:

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

B. Section 23 04 00 – General Conditions for Mechanical Trades

C. Section 23 31 00 - HVAC Ducts & Casings: Requirements for duct construction and pressure classifications.

D. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.

1.3 REFERENCES (follow the most currently adopted amended version)

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International:
   1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
   2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:
   1. UL 555 - Standard for Safety for Fire Dampers.
   2. UL 555C - Standard for Safety for Ceiling Dampers.
   3. UL 555S - Standard for Safety for Smoke Dampers.

1.4 SUBMITTALS

A. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors and duct test holes.

B. Product Data: Submit data for shop fabricated assemblies and hardware used.

C. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
   1. Fire dampers including locations and ratings.
   2. Smoke dampers including locations and ratings.
   3. Backdraft dampers.
   4. Flexible duct connections.
   5. Volume control dampers.
   6. Duct access doors.
   7. Duct test holes.

D. Product Data: For fire dampers, smoke dampers, combination fire and smoke dampers submit the following:
   1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
   2. Indicate materials, construction, dimensions, and installation details.
   3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

E. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of access doors test holes and dampers.

B. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.6 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

C. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

B. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

C. Storage: Store materials in a dry area indoor, protected from damage.

D. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Coordinate Work where appropriate with building control Work.

1.12 WARRANTY

A. Furnish five-year manufacturer warranty for duct accessories.

1.13 EXTRA MATERIALS

A. Fusible Links: Furnish quantity equal to 10 percent of number installed.

PART 2 PRODUCTS

2.1 BACK-DRAFT DAMPERS

A. Manufacturers:
   1. Ruskin CB series
   2. Price BDD Series
   3. Greenheck EM Series

B. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, extruded aluminum. Blades, maximum 6 inch width, center pivoted, with flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. Ruskin
   2. Price
   3. Greenheck
   4. Pottorff
   5. Nailor

B. Type: Dynamic, fabricate in accordance with NFPA 90A, UL 555, and UL 555S.

C. Fire Resistance: 1-1/2 hours through penetrations with fire resistance ratings of less than 3 hours and 3 hours through penetrations with fire resistance ratings of 3 hours or more.

D. Leakage Rating: Class II, maximum of 20 cfm at 4 inches wg differential pressure.

E. Damper Temperature Rating: 250 degrees F for all except smoke control systems. Smoke control systems must be 350 degrees F rated.

F. UL 555S Differential Pressure Rating: 6 in. wg.

G. UL 555S Velocity Rating: 2000 fpm

H. Frame: minimum16 gage, galvanized steel.

I. Blades:
   1. Style: Airfoil-shaped, single piece, double skin.
   2. Action: Opposed or parallel.
   3. Orientation: Horizontal.
   4. Material: Minimum 16 gage equivalent thickness, galvanized steel.
   5. Width: Maximum 6 inches.

J. Bearings: Stainless steel or Bronze Oilite pressed into frame.

K. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

L. Linkage: Concealed in frame.

M. Release Device: Electric resettable link to allow damper to be automatically reset with an open & closed indicator.

N. Actuator: shall be qualified in accordance with UL 555S to the temperature rating of the damper. Provide with damper

O. Operators: UL listed and labeled spring return electric type suitable for 120 volt, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.

P. Fusible Link Release Temperature: 165 degrees F.

Q. Finish: Mill galvanized.

R. Factory installed sleeve provided with mounting angles. Furnish silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements. Provide out-of-partition type dampers with fire rated sleeve where conditions do not allow installation of damper within partition.

S. Smoke Detector: Duct mounted smoke detectors shall be furnished by Div. 28, installed by Div. 23. Power wiring by Div. 26, control wiring by Div. 28.

2.3 DUCT ACCESS DOORS

A. Manufacturers:
1. Ruskin
2. Elgen
3. Greenheck
4. Buckley
5. Kees
6. Pottorff

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

C. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch thick insulation with sheet metal cover.
1. Less than 12 inches square, secure with sash locks.
2. Up to 18 inches Square: Furnish two hinges and two sash locks.
3. Up to 24 x 48 inches: Three hinges and two compression latches.
4. Larger Sizes: Furnish additional hinge.
5. Access panels with sheet metal screw fasteners are not acceptable.

D. Materials
1. Aluminum construction: Minimum 0.032” thick aluminum double wall door, minimum 0.032” thick aluminum frame. Provide for aluminum duct.
2. Steel construction: Minimum 24 gauge galvanized double wall door, minimum 24 gauge galvanized frame. Provide for galvanized steel duct.
3. Stainless steel construction: Minimum 24 gauge stainless steel double wall door, minimum 22 gauge stainless steel frame. Provide for stainless steel or aluminum duct.

E. Low Pressure Rectangular (Non-Grease-Ducts):
1. Door: For insulated ducts, provide double wall door with 1” or 2” insulation cavity – as necessary to accommodate required insulation. For non-insulated ducts, provide single wall door.
2. Gasket: Closed cell neoprene.
3. Hardware: Double (opposite side) cam latches or single cam latch with full length (piano style) hinge.
4. Insulation: Glass fiber type, 1” thick for ductwork with up to 1” thick acoustical lining or insulation wrap, 2” thick for ductwork with 1-1/2” and over acoustical lining or insulation wrap.

F. Low Pressure Round & Oval Duct (Non-Grease Ducts),
   1. Insulated duct, low pressure (3" wg): Welded construction, 18 gauge galvanized steel, 24 gauge galvanized double wall door, double cam latches or single cam latch with full length (piano style) hinge, 2" thick glass fiber insulation.
   2. Non-Insulated duct, low pressure (6" wg): 16 gauge galvanized door, plated steel full length (piano style) hinge, zinc plated draw latch(es) and keeper(s), closed cell neoprene gasket.

G. High pressure (10" wg): 18 gauge galvanized steel, 24 gauge galvanized double wall door, double cam latches or single cam latch with full length (piano style) hinge, 2" thick glass fiber insulation.
   1. Hardware:
      a. Cam latch type: Cam latches on (4) sides - (1) cam latch per side for 6"x6", (2) cam latches per side for 8"x8" and over.
      b. Hinge type: Cam latches on (3) sides, (1) cam latch per side for up to 16"x16", (2) cam latches per side for 18"x18" and over.
   2. Application: For ductwork rated over 3" pressure class positive or negative, provide high pressure access doors.

H. Grease Ducts: 16 gauge galvanized door, 16 gauge cold rolled steel (CRS) frame, 2,300°F ceramic fire gasket, UL 1978 Listed. Provide access doors where indicated on the drawings and where cleanouts are required by IMC Section 506.3.
   1.

2.4 DYNAMIC FIRE DAMPERS

A. Manufacturers:
   1. Ruskin
   2. Price
   3. Greenheck
   4. Nailor
   5. Pottorff

B. Fabricate in accordance with NFPA 90A and UL 555.

C. Fire Resistance: 1-1/2 hours through penetrations with fire resistance ratings of less than 3 hours and 3 hours through penetrations with fire resistance ratings of 3 hours or more.

D. Dynamic Closure Rating: Dampers classified for dynamic closure to 2000 fpm and 4 inches wg static pressure.

E. Construction:
   1. Integral Sleeve Frame- Galvanized steel in gauges required by manufacturer's UL listing. Length: Minimum 20 gage formed Sleeve length shall extend approximately 3" on either side of the wall or floor to facilitate joining the collar to the duct.
   2. Blades:
      a. Style: Curtain type, blades outside of airstream.
      b. Action: Spring or gravity closure upon fusible link release.
      c. Material: Minimum 24 gage roll formed, galvanized steel.
   3. Closure Springs: Type 301 stainless steel, constant force type, if required.

F. Fusible Link Release Temperature: 165 degrees F.

G. Mounting: Vertical or horizontal as indicated on Drawings.

H. Finish: Mill galvanized.

2.5 SMOKE DAMPERS

A. Manufacturers:
1. Ruskin
2. Air Balance
3. Greenheck
4. Nailor
5. Pottorff

B. Fabricate in accordance with NFPA 90A and UL 555S.

C. Fire Resistance: 1-1/2 hours through penetrations with fire resistance ratings of less than 3 hours and 3 hours through penetrations with fire resistance ratings of 3 hours or more.

D. Leakage Rating: Class I, maximum of 8 cfm at 4 inches wg differential pressure..

E. Damper Temperature Rating: 250 degrees F.

F. Frame: 16 gage, galvanized steel.

G. Blades:
1. Style: Airfoil-shaped, single piece, double skin.
2. Action: Opposed.
3. Orientation: Horizontal.
4. Material: Minimum 13 gage equivalent thickness, galvanized steel.
5. Width: Maximum 6 inches.

H. Bearings: Stainless steel pressed into frame.

I. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

J. Linkage: Concealed in frame.

K. Operators: UL listed and labeled spring return electric type suitable for 120 volt, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.

L. Sleeve: Factory installed 16 gage sleeve, minimum 12 inches long.

M. Finish: Mill galvanized.

N. Smoke Detector: Duct mounted smoke detectors are furnished by Div. 28, installed by Div. 23. Power wiring by Div. 26, control wiring by Div. 28

2.6 VOLUME CONTROL DAMPERS

A. Manufacturers:
1. Ruskin
2. Nailor
3. Greenheck
4. Flexmaster
5. McGill Airflow
6. Pottorff

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Splitter Dampers:
1. Material: Same gage as duct to 24 inches size in both dimensions, and two gages heavier for sizes over 24 inches.
2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
3. Operator: Minimum 3/8 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.
4. Single Blade Dampers: Fabricate for duct sizes up to 12 x 48 inch.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.

E. End Bearings: Except in round ductwork 12inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg..

F. Quadrants:
1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.7 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
1. Ventfabrics Inc. Ventglas
2. United McGill
3. Elgen
4. DuroDyne
5. Ventfabrics
6. Ductmate Industries

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Materials: Flame-retardant or noncombustible fabrics.

D. Coatings and Adhesives: Comply with UL 181, Class 1.

E. Metal-Edged Connectors: Factory fabricated with a fabric strip minimum 3-1/2 inches wide attached to two strips of galvanized or aluminum sheet steel. Provide metal compatible with connected ducts.

F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
   1. Minimum Weight: 26 oz./sq. yd.
   2. Tensile Strength: 480 lbf/inchin the warp and 360 lbf/inchin the filling.
   3. Service Temperature: Minus 40 to plus 200 deg F.

G. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
   1. Minimum Weight: 24 oz./sq. yd.
   2. Tensile Strength: 530 lbf/inchin the warp and 440 lbf/inchin the filling.
   3. Service Temperature: Minus 50 to plus 250 deg F

H. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
   1. Minimum Weight: 16 oz./sq. yd.
   2. Tensile Strength: 285 lbf/inchin the warp and 185 lbf/inchin the filling.
   3. Service Temperature: Minus 67 to plus 500 deg F

I. High-Corrosive-Environment System, Flexible Connectors:Glass fabric with chemical-resistant coating.
   1. Minimum Weight: 14 oz./sq. yd.
   2. Tensile Strength: 450 lbf/inchin the warp and 340 lbf/inchin the filling.
   3. Service Temperature: Minus 67 to plus 500 deg F

J. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs. per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.8 DUCT TEST HOLES

A. Manufacturers:
   1. Dwyer
   2. Flow Kinetics
   3. Air Balance
   4. Substitutions: Division 01 - General Requirements.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

2.9 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
   1. Pottorff.
   2. Ventfabrics, Inc.
   3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass, Copper or Aluminum.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Painted steel.

2.10 TURNING VANES

A. Manufacturers:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. METALAIRE, Inc.
5. SEMCO Incorporated.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify rated walls are ready for fire damper installation.

B. Verify ducts and equipment installation are ready for accessories.

C. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION.

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Install motorized back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.

C. Access Doors: Install access doors of type suitable for application at the following locations:

1. Spaced every 50 feet of straight duct.
2. Upstream of each elbow.
3. Upstream of each reheat coil.
4. Before and after each duct mounted filter.
5. Before and after each duct mounted coil.
6. Before and after each duct mounted fan.
7. Before and after each automatic control damper.
8. Before and after each fire damper, smoke damper, combination fire and smoke damper.
9. Downstream of each VAV box.
10. Install at locations for cleaning kitchen exhaust ductwork in accordance with NFPA 96.

D. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access. Install 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
1. Mark access doors for fire and smoke dampers on outside surface, with minimum 1/2 inch high letters reading: FIRE/SMOKE DAMPER, SMOKE DAMPER, OR FIRE DAMPER.

E. Install temporary duct test holes and required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

F. Install fire dampers, combination fire and smoke dampers and smoke dampers at locations as indicated on Drawings and as indicated in specifications. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges. Install dampers and accessories with required clearance for access. Provide all power and control wiring for a complete and operable system.
1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
2. Install dampers square and free from racking with blades running horizontally.
3. Do not compress or stretch damper frame into duct or opening.
4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.3 DEMONSTRATION

A. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION

SECTION 233400 - HVAC FANS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof ventilators.

B. Wall exhausters.

C. Cabinet exhaust fans.

D. Ceiling exhaust fans.

E. Downblast roof exhausters

F. Inline centrifugal fans

G. Kitchen hood upblast roof exhausters.

H. Utility vent sets.

I. Laboratory and fume exhaust.

J. Centrifugal blower fans

K. Vaneaxial fans.

L. Mixed Flow fans.

M. Propeller fans.

N. Gravity roof ventilators.

O. Motors and drives.

P. Fan accessories.

Q. HVLS (High Volume Low Speed) Fans

R. Dryer Booster Fans

1.2 RELATED REQUIREMENTS

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

B. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 0700 - HVAC Insulation.

D. Section 23 3300 - Air Duct Accessories: Dampers.

E. REFERENCE STANDARDS (follow the most currently adopted amended version)ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings.

F. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings.

G. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program.

H. AMCA 99 - Standards Handbook.

I. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

J. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

K. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data;.

L. NEMA MG 1 - Motors and Generators.

M. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

N. UL-705 – Standard for Safety for Power Ventilators

1.3 SUBMITTALS

A. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

B. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Include complete installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

E. Maintenance Materials: Furnish for Owner's use in maintenance of project.

F. Extra Materials:
1. Fan Belts: One set for each individual fan.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.6 FIELD CONDITIONS

A. Permanent fans may not be used for ventilation during construction.

B. Permanent fans may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The following list of manufacturers applies to all fans unless otherwise noted in sections below.
   1. Greenheck Fan Corporation
   2. Loren Cook Company
   3. PennBarry
   4. Twin City Fan & Blower

2.2 STARTERS, DRIVES & DISCONNECTS

A. Provide starters and disconnect switches for all fans not scheduled to be controlled by a variable frequency drive.

B. Provide belt or direct drive fans as indicated on project schedules. Where belt drives are indicated provide the following:
   1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
   2. Belts: Static free and oil resistant.
   3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
   4. Motor pulley adjustable for final system balancing.
   5. Readily accessible for maintenance.
   6. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

C. Disconnect Switches:
   1. Factory mounted and wired.
   2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.

3. Finish for Painted Steel Enclosures: Provide manufacturer's standard, factory applied gray, unless otherwise indicated.
4. Positive electrical shutoff.
5. Wired from fan motor to junction box installed within motor compartment.

2.3 ROOF CURBS

A. Provide roof curbs for all roof mounted fans and ventilators unless specifically noted otherwise.

B. Self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, curb bottom, factory installed nailer strip. Provide pitched roof curb where architectural roof plans indicate sloped roof.

C. Curb Height: 24 inches for intakes and 14 inches for exhausts.

2.4 ROOF VENTILATORS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
1. Refer to Section 2.1.

B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

C. Motorized Damper: aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

2.5 WALL EXHAUSTERS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
1. Refer to Section 2.1.

B. Fan Unit: V-belt or direct driven with spun aluminum housing; resiliently mounted motor; 1/2 inch mesh, 0.062 inch thick aluminum wire bird screen.

C. Motorized Damper: aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

2.6 CABINET AND CEILING EXHAUST FANS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
1. Refer to Section 2.1.

B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

C. Grille: Molded white plastic.

2.7 DOWNBLAST ROOF EXHAUSTERS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
   1. Refer to Section 2.1.
   2. Housing:
      a. Construct of heavy gage aluminum including curb cap, windband, and motor compartment.
      b. Rigid internal support structure.
      c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
      d. Construct drive frame assembly of heavy gage steel, mounted on vibration isolators.
      e. Provide breather tube for fresh air motor cooling and wiring.

B. Shafts and Bearings:
   1. Fan Shaft:
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings:
      a. Permanently sealed or pillow block type.
      b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
      c. 100 percent factory tested.

C. Drain Trough: Allows for single-point drainage of water and other residues.

D. Accessories:
   1. Automatic Belt Tensioner: Automatic device that adjusts for correct belt tension for single drives.
   2. Birdscreen:
      a. Provide galvanized steel construction.
      b. Protects fan discharge.
   3. Dampers: Provide motorized type.
   4. Finishes: Factory primed.
   5. Hinge Kit:
      a. Aluminum hinges.
      b. Hinges and restraint cables mounted to base (sleeve).
      c. Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.
   6. Heat Baffle: Prevents heat from radiating into motor compartment.
   7. Tie-down Points: Four brackets located on windband secures fan in heavy wind applications.
   8. External motor speed controllers for field mounting.

2.8 INLINE CENTRIFUGAL FANS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
   1. Refer to Section 2.1.

B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

2.9 KITCHEN HOOD UPBLAST ROOF EXHAUSTERS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
   1. Refer to Section 2.1.

B. Belt Drive Fan:
   1. Fan Wheel:
      a. Type: Non-overloading, backward inclined centrifugal.
      b. Material: Aluminum.
      c. Statically and dynamically balanced.
   2. Motors:
      a. Open drip-proof (ODP).
      b. Heavy duty ball bearing type.
      c. Mount on vibration isolators or resilient cradle mounts, out of air stream.
      d. Fully accessible for maintenance.
   3. Housing:
      a. Construct of heavy gage aluminum including curb cap, windband, and motor compartment.
      b. Rigid internal support structure.
      c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
      d. Construct drive frame assembly of heavy gage steel, mounted on vibration isolators.
      e. Provide breather tube for fresh air motor cooling and wiring.

C. Shafts and Bearings:
   1. Fan Shaft:
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings:
      a. Permanently sealed or pillow block type.
      b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
      c. 100 percent factory tested.

D. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

E. Accessories:
   1. Automatic Belt Tensioner: Automatic device that adjusts for correct belt tension for single drives.
   2. Birdscreen:
      a. Provide galvanized steel construction.
      b. Protects fan discharge.
   3. Clean Out Port: Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.
   4. Roof Curb Extension: Vented curb extension where required for compliance with minimum clearances required by NFPA 96.
   5. Dampers: Provide motorized type.
   6. Drain Connection:
      a. Aluminum construction.

b. Allows single-point drainage of grease, water, or other residues.

7. Finishes: Factory primed.
8. Grease Trap:
   a. Aluminum.
   b. Includes drain connection.
   c. Collects grease residue.
9. Hinge Kit:
   a. Aluminum hinges.
   b. Hinges and restraint cables mounted to base (sleeve).
   c. Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.
10. Heat Baffle: Prevents heat from radiating into motor compartment.
11. Tie-down Points: Four brackets located on windband secures fan in heavy wind applications.
12. External motor speed controllers for field mounting.
13. UL-762 Rating.

2.10 UTILITY VENT SET

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
   1. Refer to Section 2.1.

B. Motors:
   1. Open drip-proof (ODP).
   2. Heavy duty ball bearing type.
   3. Mount on vibration isolators or resilient cradle mounts, out of air stream.
   4. Fully accessible for maintenance.

C. Housing:
   1. Construct of heavy gage aluminum including curb cap, windband, and motor compartment.
   2. Rigid internal support structure.
   3. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
   4. Construct drive frame assembly of heavy gage steel, mounted on vibration isolators.
   5. Provide breather tube for fresh air motor cooling and wiring.

D. Shafts and Bearings:
   1. Fan Shaft:
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings:
      a. Permanently sealed or pillow block type.
      b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
      c. 100 percent factory tested.

E. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

F. Accessories:

1. Automatic Belt Tensioner: Automatic device that adjusts for correct belt tension for single drives.
2. Birdscreen:
   a. Provide galvanized steel construction.
   b. Protects fan discharge.
3. Clean Out Port: Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.
4. Dampers: Provide motorized type.
5. Drain Connection:
   a. Aluminum construction.
   b. Allows single-point drainage of grease, water, or other residues.
6. Finishes: Factory primed.
7. Hinge Kit:
   a. Aluminum hinges.
   b. Hinges and restraint cables mounted to base (sleeve).
   c. Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.
8. Heat Baffle: Prevents heat from radiating into motor compartment.
9. Tie-down Points: Four brackets located on windband secures fan in heavy wind applications.
10. External motor speed controllers for field mounting.

2.11 LABORATORY AND FUME EXHAUST

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
   1. Refer to Section 2.1.

B. General Requirements:
   1. Provide fan types tested in accordance with AMCA 210, AMCA Standard 260 (Induced Flow Fans) and AMCA 300 in an AMCA-accredited laboratory.
   2. Provide fan units rated according to AMCA Standard 211 (air performance) and AMCA Standard 311 (sound performance).

C. Fan Assemblies:
   1. Provide unit suitable for maintaining structural integrity and operation in 125 mile per hour wind without external guy - wires or supplemental supports when mounted on manufacturer-supplied roof curbs.

D. Belt Drive Fan:
   1. Centrifugal Fan Impeller
      a. Fan impeller shall be non-overloading, steel centrifugal, backward inclined, flatblade type. Blades shall be continuously welded to the backplate and deep spun inlet wheel shroud.
      b. Fan impeller hub shall be keyed and securely attached to the fan shaft.
      c. Fan impeller shall be statically and dynamically balanced in accordance with AMCA Standard 204-96, “Balance Quality and Vibration Levels for Fans.”
      d. Fan impeller shall be coated with a finish to match the fan housing.
      e. Fan impeller shall be balanced utilizing weights which are welded and coated with chemical resistant coating. Balancing by means of bolts and washers shall not be acceptable.

f. Belt driven fan bearings shall be designed and tested specifically for use in air handling applications. Construction shall be heavy duty regreaseable ball or roller type in a cast iron pillow block housing utilizing concentric mounting locking collars. Belt driven fan bearings shall be selected for a minimum L50 life of not less than 200,000 hours.

g. Belt driven fan units shall have stainless steel lube lines installed from the fan bearings with Zerk fittings to allow for easy lubrication.

2. Statically and dynamically balanced.

3. Motors:
   a. Open drip-proof (ODP).
   b. Heavy duty ball bearing type.
   c. Mount on vibration isolators or resilient cradle mounts, out of air stream.
   d. Fully accessible for maintenance.

4. Housing:
   a. Fan housing shall be a minimum 12 gauge steel construction.
   b. Adjustable motor plate, where applicable shall utilize threaded studs for positive belt tensioning.
   c. Fan shall be constructed with an integral housing drain to alleviate rainwater.
   d. Fan shall contain a bolted and gasketed access door. Access door shall allow for the removal of wheel, shaft and bearings without the removal of the fan from the laboratory exhaust system.
   e. Belt driven fan shafts shall be stainless steel and accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum fan RPM.
   f. Unit fasteners exposed to corrosive airstream shall be of stainless steel construction.
   g. Unit components fabricated of steel shall be coated with an electrostatically applied, high performance, baked phenolic epoxy powder coating with an ultraviolet protective topcoat. Finish color shall be light gray. Coating thickness shall be 5.0 mils. Coating shall be salt spray tested per ASTM B117 for in excess of 1000 hours without failure, humidity resistance tested per ASTM D2247 for in excess of 1000 hours without failure, and impact resistance tested per ASTM D2794 and shall pass a minimum of 100 in-lbs.
   h. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM.
   i. Units specified as Spark Resistant Construction shall be constructed to the AMCA Spark Resistant Construction level as dictated on the plans and specifications.
   j. Unit shall be shipped in ISTA Certified Transit Tested Packaging.

E. Shafts and Bearings:
   1. Fan Shaft:
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings:
      a. Permanently sealed or pillow block type.
      b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.

c. 100 percent factory tested.

F. High Plume Discharge Nozzle with Integral Windband:
1. Provide combination discharge nozzle and windband to induce ambient airflow from outside fan housing and increase discharge velocities to velocities that comply with ANSI Z9.5, minimum 3,000 feet per minute.
2. Provide a windband with a minimum of 120 inches discharge height above the roof surface.
3. Provide sound attenuated windband that does not increase overall height of fan system.
4. Provide drain connection at lowest point of housing.

G. Mounting Base: Provide mounting base with lifting lugs.

H. Bypass Air Plenum
1. Bypass air plenum shall be designed to support fan assembly (assemblies) and configuration(s) as shown on the contract drawings.
2. Bypass air plenum shall introduce outside air above the roof level and shall have rain hood(s) and bird screen protection over the bypass air damper(s).
3. Bypass air plenum shall be constructed of welded steel, minimum 14 gauge, with a finish to match the fan housing.
4. Bypass dampers shall be opposed blade low leakage design. The dampers shall be aluminum construction and coated to match the fan housing.
5. Provide with extended shafts and manual locking quadrant handles shall be provided for adjustment of the dampers. The extended shaft can be used for external connection to actuators by controls contractor.

I. Isolation Dampers:
1. Parallel blade design, constructed of galvanized steel.
2. Provide 24 volt-powered, modulating actuator, rated for NEMA 2/IP54 environment, to coordinate with fan operation.

J. Bypass Dampers:
1. Provide modulating bypass damper to maintain fan discharge velocity.
2. Provided opposed blade design, constructed of galvanized steel.
3. Provide 24 volt-powered, modulating actuator, rated for NEMA 2/IP54 environment, to coordinate with fan operation.

K. Piezometer Ring: Provide piezometer ring type differential pressure device with connections for field-installed flow measuring instrumentation.
1. Pressure Transducer without Display: Provide piezometer ring and transducer to convert differential pressure readings to 4 - 20 mA DC signal proportional to flow.
2. Pressure Transducer/Transmitter with Display:
a. Provide piezometer ring and transducer with local digital display to convert differential pressure readings to 4 - 20 mA DC signal proportional to flow. Include two independently adjustable SPDT dry-contact outputs.
b. Provide the display in a NEMA 4X enclosure.

L. Accessories:

1. Automatic Belt Tensioner: Automatic device that adjusts for correct belt tension for single drives.
2. Inlet Safety Screen:
   a. Provide welded wire safety screens fabricated for easy installation and removal.
3. Birdscreen:
   a. Provide galvanized steel construction.
   b. Protects fan discharge.
4. Dampers: Provide motorized type.
5. Drain Connection:
   a. Aluminum construction.
   b. Allows single-point drainage of grease, water, or other residues.
6. Finishes: Factory primed.
7. Heat Baffle: Prevents heat from radiating into motor compartment.
8. Tie-down Points: Four brackets located on windband secures fan in heavy wind applications.
9. External motor speed controllers for field mounting.

2.12 CENTRIFUGAL BLOWER FANS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
   1. Refer to Section 2.1.

B. Wheel and Inlet
   1. Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
   2. Forward Curved: Black enameled steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.
   3. Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
   4. Radial: Steel construction with inlet flange, heavy reinforced back plate, plate blades with reinforcing gussets welded or riveted to back plate and flange; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.

C. Housing
   1. Heavy gage steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut
   2. Factory finish before assembly to manufacturer's standard. For fans handling air downstream of humidifiers, provide two additional coats of paint. Prime coating on aluminum parts is not required.
   3. Provide bolted construction with horizontal flanged split housing, where indicated.
   4. Fabricate plug fans without volute housing, in lined steel cabinet. Refer to Section 23 0713.

D. Bearings and Drives
1. Bearings: Heavy duty pillow block type, selfgreasing ball bearings, with ABMA STD 9 life at 50,000 hours.
2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard.
3. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under, selected so required rpm is obtained with sheaves set at mid Fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
4. Belt Guard: Fabricate to SMACNA (DCS); 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

E. Accessories
1. Inlet/Outlet Screens: Galvanized steel welded grid.
2. Access Doors: Shaped to conform to scroll, with quick opening latches and gaskets.
3. Scroll Drain: 1/2 inch steel pipe coupling welded to low point of fan scroll.

2.13 AXIAL FANS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
1. Refer to Section 2.1.

B. Hub and Impeller:
1. Airfoil Impeller Blades: Adjustable die cast aluminum alloy glass reinforced polyester resin.
2. Hub: Die cast aluminum alloy or cast iron hub or with belt drive of spun, welded steel, bored and keyed to shaft; to facilitate indexing of blade angle with automatic adjustment stops.
3. Controllable Pitch Assemblies: Incorporate ball bearing counterbalanced blade and variable pitch assembly into hub with mechanical link to casing exterior mounted actuator, or pneumatic or electric actuator incorporated within hub.
4. Cast Components: X-ray components after fabrication and statically and dynamically balance assembly before attachment to motor or shaft.

C. Casing:
1. Fabricate casing of 1/4 inch steel for fans 40 inch in diameter and smaller and 3/8 inch steel for larger fans.
2. Continuously weld, with inlet and outlet flange connections, and motor or shaft supports. Incorporate flow straightening guide vanes for fans specified for static pressures greater than one inch wg.
3. Finish with one coat enamel applied to interior and exterior.

D. Bearings and Drives:
1. Bearings: Heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, with ABMA STD 9, L-10 life at 50,000 hours.
2. Shafts: Hot rolled steel, ground and polished, with keyway; protectively coated with lubricating oil.

3. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
4. Belt Guard: Fabricate to SMACNA (DCS); 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
5. Lubrication: Extend lubrication fittings to outside of casing.

E. Accessories:
1. Inlet Bell: Bell mouth inlet fabricated of steel with flange.
2. Outlet Cones: Fabricated of steel with flanges, outlet area/inlet area ratio of 1.5/1.0, with center pod as recommended by manufacturer.
3. Inlet Screens: Galvanized steel welded grid to fit inlet bell.
4. Access Doors: Shaped to conform to casing with quick opening latches and gaskets.

2.14 MIXED FLOW FANS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
1. Refer to Section 2.1.

B. Hub and Impeller:
1. Airfoil Impeller Blades: Adjustable die cast aluminum alloy glass reinforced polyester resin.
2. Hub: Die cast aluminum alloy or cast iron hub or with belt drive of spun, welded steel, bored and keyed to shaft; to facilitate indexing of blade angle with automatic adjustment stops.
3. Cast Components: X-ray components after fabrication and statically and dynamically balance assembly before attachment to motor or shaft.

C. Casing:
1. Fabricate casing of 1/4 inch steel for fans 40 inch in diameter and smaller and 3/8 inch steel for larger fans.
2. Continuously weld, with inlet and outlet flange connections, and motor or shaft supports. Incorporate flow straightening guide vanes for fans specified for static pressures greater than one inch wg.
3. Finish with one coat enamel applied to interior and exterior.

D. Bearings and Drives:
1. Bearings: Heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, with ABMA STD 9, L-10 life at 50,000 hours.
2. Shafts: Hot rolled steel, ground and polished, with keyway; protectively coated with lubricating oil.
3. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

4. Belt Guard: Fabricate to SMACNA (DCS); 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
5. Lubrication: Extend lubrication fittings to outside of casing.

E. Accessories:
1. Inlet Bell: Bell mouth inlet fabricated of steel with flange.
2. Outlet Cones: Fabricated of steel with flanges, outlet area/inlet area ratio of 1.5/1.0, with center pod as recommended by manufacturer.
3. Inlet Screens: Galvanized steel welded grid to fit inlet bell.
4. Access Doors: Shaped to conform to casing with quick opening latches and gaskets.

2.15 PROPELLER FANS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
1. Refer to Section 2.1.

B. Impeller: Shaped steel or steel reinforced aluminum blade with heavy hubs, statically and dynamically balanced, keyed and locked to shaft, directly connected to motor or provided with V-belt drive.

C. Frame: One piece, square steel with die formed venturi orifice, mounting flanges and supports, with baked enamel finish.

D. Accessories:
1. Outlet Damper: Multiple blade with offset hinge pin, blades linked, line voltage motor drive, power open, spring return.
2. Safety Screens: Expanded galvanized metal over inlet, motor, drive; to comply with OSHA regulations.
3. Hood: Weathershield, to exclude rain and snow.
4. Controller: Solid-state speed controller.

2.16 GRAVITY ROOF VENTILATORS

A. Manufacturer: Refer to Section 2.1.

B. Product Description: Square type, with aluminum housing; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.

C. Motor Operated Damper: Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and line voltage motor drive, power open, spring return.

2.17 HVLS (HIGH VOLUME LOW SPEED) FANS

A. Manufacturers:
1. Hunter Industrial
2. MacroAir Fans
3. Big Ass Fans

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Fans shall be supported from structure, direct drive permanent split capacitor type; with rolled edge design fan blade set.

C. Provide with accessories as shown on plans.

D. Provide with (1) wall mounted controller to control (4) fans. Furnish and install control panel with Bacnet card and fire alarm relay.

E. Color selected by architect.

2.18 DRYER BOOSTER INLINE FANS

A. Manufacturers:
1. Fantech
2. Enervex
3. US Draft

B. Fan: Inline fan with galvanized steel housing and baked powder-coat finish. Backward inclined blades of the motorized impeller allow lint to pass through the fan.

C. Pressure Switch: pressure switch automatically activates the booster fan when dryer comes on. Includes 18" of pressure sensing tubing with mounting grommet.

D. Indicator Panel: Wall-mount, low voltage indicator panel features an LED light that indicates to the owner that the fan is working properly. The indicator panel will alert of problems such as no power, blocked duct, locked motor rotor and low speed conditions. A 50 foot cable is included to connect the indicator panel to the booster fan. Panel shall have Bacnet compatibility for monitoring and alarms.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 0548.

C. Install flexible connections between fan inlet and discharge ductwork; refer to Section 23 0548. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

D. Install fan restraining snubbers; refer to Section 23 0548. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

E. Provide safety screen where inlet or outlet is exposed.

F. Pipe scroll drains to nearest floor drain.

G. Provide motorized dampers on discharge of exhaust fans and as indicated; refer to Section 23 3100.

H. Provide floor mounted axial fans with reinforced legs. Provide ceiling suspended units with support brackets bolted to casing flange.

END OF SECTION

SECTION 233600 - AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single-duct terminal units.
   1. Single-duct, variable-volume units.

B. Fan-powered units.

C. Air volume control valves.

1.2 RELATED REQUIREMENTS

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

B. Section 22 0548 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

C. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Section 23 0923 - Direct-Digital Control System for HVAC.

E. Section 23 2113 - Hydronic Piping: Connections to heating coils.

F. Section 23 2114 - Hydronic Specialties: Connections to heating coils.

G. Section 23 3100 - HVAC Ducts and Casings.

H. Section 23 3300 - Air Duct Accessories.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils

B. AHRI 880 (I-P) - Performance Rating of Air Terminals.

C. AHRI 885 - Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

D. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

E. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality.

F. ASHRAE Std 130 - Methods of Testing Air Terminal Units.

G. ASTM A492 - Standard Specification for Stainless Steel Rope Wire.

H. ASTM A603 - Standard Specification for Zinc-Coated Steel Structural Wire Rope.

I. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

K. ASTM E488 - Standard Test Methods for Strength of Anchors in Concrete Elements.

L. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction.

N. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

O. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association.

P. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

Q. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

A. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

B. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
   1. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg .

C. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

D. Project Record Documents: Record actual locations of units and locations of access doors required for access of electrical components.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 WARRANTY

A. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The following list of manufacturers applies to all air terminal units unless otherwise noted in sections below.
   1. Price Industries
   2. Titus
   3. Trane
   4. Carrier
   5. Johnson Controls Inc. / Enviro-Tec

2.2 SINGLE-DUCT, VARIABLE-VOLUME UNITS

A. Acoustic Performance Requirements:
   1. Sound ratings of air distribution assemblies: Not to exceed 25 NC at scheduled pressure Use attenuation values found in appendix E of AHRI 885.

B. General:
   1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
   2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

C. Unit Casing:
   1. Minimum 22 gage, 0.0299 inch galvanized steel.
      a. Assembled with longitudinal lock seam construction.
      b. Casing leakage to meet ASHRAE Std 130.
   2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
   3. Unit Discharge: Rectangular, with slip-and-drive connections.
   4. Acceptable Liners:
      a. 1/2 inch thick, coated, fibrous-glass complying with ASTM C1071.
         1) Secure with adhesive.
         2) Coat edges exposed to airstream with NFPA 90A approved sealant.
         3) Cover liner with non-porous foil.

b. 3/4 inch (19 mm) thick polyurethane foam adhesive complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke developed index of 50 for both insulation and adhesive, when tested in accordance with ASTM E84.
c. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

D. Sound Attenuator:
1. Provide if required to meet scheduled acoustical performance requirements.
2. Construction to consist of a continuous extension of the casing and liner as required to achieve required attenuation.
3. At 2000 fpm inlet velocity, the minimum operating pressure with attenuator added not to exceed 0.14 inch wg.

E. Damper Assembly:
1. Heavy-gage, galvanized steel or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak damper blades for tight airflow shutoff.
a. Air Leakage Past Closed Damper: Maximum two percent of unit maximum airflow at 3 inch wg inlet static pressure, tested in accordance with ASHRAE Std 130.

F. Electric Heating Coil:
1. Listed and provided by the terminal unit manufacturer.
2. Coil Casing: 20 gage, 0.0359 inch galvanized steel.
3. Heating Elements: Nickel chrome, supported by ceramic insulators.
4. Integral Control Panel: NEMA 250, Type 2 enclosure with hinged access door for access to all controls and safety devices.
5. Furnish a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow.
6. Provide the following additional components, mounted and/or wired within the control enclosure:
a. Fused or non-fused door interlocking disconnect switch.
b. Mercury contactors.
c. Fuse block.
7. Factory wired, including all limit switches and steps of control as shown on the equipment schedule, with the SSR (solid-state relay) proportional heat control.
8. Provide SCR (Silicon Controlled Rectifier) controller.

G. Electrical Requirements:
1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

H. Control Transformers: Factory supplied and mounted for electric and electronic control applications.

I. Controls:
1. Electric:
a. Damper Actuator: 24 volt, powered closed, spring return open.

b. Wall-mounted thermostat with Celsius and Fahrenheit display including clock display and set-point of occupied space.
c. See Section 23 0913.

2. Electronic:
   a. Damper Actuator: 24 volt, power closed, spring return open.
   b. Velocity Controller:
      1) Settings for minimum/maximum air volumes, factory-calibrated, and field adjustable at thermostat.
      2) Maintain constant airflow dictated by thermostat to within 5 percent of set point while compensating for inlet static-pressure variations up to 4 inch wg, when tested in accordance with ASHRAE Std 130.
      3) Provide controller with multi-point with velocity sensors located in air inlets and outlet.
   c. Thermostat: Wall-mounted, time-proportional with reheat-coil control including a temperature set-point display in Fahrenheit.
   d. See Section 23 0913.

3. DDC (Direct-Digital Controls):
   a. Include a factory-installed, unit-mounted, direct-digital controller that includes the following:
      1) 24 VAC power terminal or RJ-12 Power connection.
      2) T-Stat Port for thermostat connection.
      3) Service Port for Price Linker diagnostic equipment.
      4) Damper actuator.
      5) Fan output connection.
      6) LED indication for troubleshooting.
      7) Three binary staged heating outputs.
      8) Binary cooling output.
      9) S.A.T. sensor input.
      10) Contact closure input.
      11) Four analog outputs.
      12) BACNET expansion module.
      13) VAV expansion module.
   b. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
   c. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum airflow.
      1) Occupied and unoccupied operating mode.
      2) Remote reset of temperature or CFM set points.
      3) Proportional, plus integral control of room temperature.
      4) Monitoring and adjusting with portable terminal.
      5) Time-proportional reheat coil control.
   d. Room Sensor:
      1) Compatible with temperature controls specified.
      2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.

4. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
   a. Plastic parts shall be fire-resistant, complying with UL 94.

b. Signal accuracy: within 5 percent throughout operating range with a 90 degree sheet metal elbow directly at the inlet of the assembly.
c. Control tubing shall be protected by grommets at the wall of the air flow sensor's housing.
d. Provide sensor with a pressure transducer to interface with a DDC system.
e. Provide velocity pressure sensor with a removable access section for maintenance.
f. Suitable for operation with duct pressures between 0.25 and 3.0 inch wg inlet static pressure.
g. Include factory-mounted and piped, 5-micron filter; and adjustable, velocity-resetting, high-limit control with amplifying relay.

2.3 AIR VOLUME CONTROL VALVES

A. Manufacturers:
1. Price Industries, Inc.
2. Accutrol
3. Johnson Controls, Inc.
4. Tuttle and Bailey.
5. Phoenix Controls
6.

B. Basis of Design: Price Industries, Inc.
1. Fume Hood Control Valve: LDV, (direct digital controls).
2. Fume Hood Control Valve with Silencer: LDVQ, (direct digital controls).
3. Laboratory Control Valve: RDV/SS, (direct digital controls).
4. General Exhaust Control Valve: RDV, (direct digital controls).
5. General Exhaust Control Valve with Silencer: RDVQ, (direct digital controls).

C. General:
1. Factory-assembled air volume control valves rated in accordance with AHRI 880 (I-P).
2. Clearly label each unit indicating maximum/minimum cfm, tag/mark number, model number, and manufacturer's order number.

D. Construction:
1. Casing: Minimum 20 gage, 0.0375 inch Type 316L stainless steel suitable for welding in place without distortion, meeting the requirements of NFPA 90A and UL 181.
2. Acoustically and thermally lined casing with minimum 1/2 inch, dual-density insulation, meeting the requirements of NFPA 90A, UL 181, and ASTM C1071.
3. Damper: Minimum 22 gage, 0.0299 inch Type 316L stainless steel with teflon damper shaft bearings and damper gasket.
4. Air Leakage: Not exceed 2 percent of the nominal catalog rating 3 inch wg inlet static pressure when tested in accordance with ASHRAE Std 130.
5. Controls Enclosure: 22 gage, 0.0299 inch zinc-coated steel.
6. Air volume control assemblies to consist of galvanized steel damper, steel, cylindrical flow diverter valve, sliding gate valve, or Manufacturer’s standard damper design.

E. Electrical Requirements:

1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

F. Controls:
1. DDC (Direct-Digital Controls):
   a. Include a factory-installed, unit-mounted, direct-digital controller that includes the following:
      1) 24 VAC power terminal or RJ-12 Power connection.
      2) T-Stat Port for thermostat connection.
      3) Service Port for Price Linker diagnostic equipment.
      4) Damper actuator.
      5) Fan output connection.
      6) LED indication for troubleshooting.
      7) Three binary staged heating outputs.
      8) Binary cooling output.
      9) S.A.T. sensor input.
      10) Contact closure input.
      11) Four analog outputs.
      12) BACNET expansion module.
      13) VAV expansion module.
   b. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
   c. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum airflow.
      1) Occupied and unoccupied operating mode.
      2) Remote reset of temperature or airflow set points.
      3) Proportional, plus integral control of room temperature.
      4) Monitoring and adjusting with portable terminal.
      5) Time-proportional reheat coil control.
   d. Room Sensor:
      1) Compatible with temperature controls specified.
      2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.
2. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
   a. Plastic parts shall be fire-resistant, complying with UL 94.
   b. Signal accuracy: Plus/minus five percent throughout terminal operating range with a 90 degree sheet metal elbow directly at the inlet of the assembly.
   c. Control tubing shall be protected by grommets at the wall of the air flow sensor's housing.
   d. Provide sensor with a pressure transducer to interface with a DDC system.
   e. Provide velocity pressure sensor with a removable access section for maintenance.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conditions are suitable for installation.

B. Verify that field measurements are as shown on the drawings.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. See drawings for the size(s) and duct location(s) of the air terminal units.

D. Provide ceiling access doors or locate units above easily removable ceiling components.

E. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.
   1. See Section 23 0548.

F. Embed anchors in concrete in accordance with ASTM E488.

G. Do not support from ductwork.

H. Connect to ductwork in accordance with Section 23 3100.

I. Provide minimum of 5 ft of 1 inch thick lined ductwork downstream of units.

J. Install heating coils in accordance with Section 23 8200.

K. Verify that electric power is available and of the correct characteristics.

3.3 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

3.4 FIELD QUALITY CONTROL

A. Provide manufacturer's field representative to test, inspect, instruct, observe, field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.
   1. Leak Test:
      a. After installation, fill water coils and test for leaks.
      b. Repair leaks and retest until no leaks exist.
   2. Operational Test:
      a. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

b. Test and adjust controls and safeties.
c. Replace damaged and malfunctioning controls and other equipment.
d. Remove and replace malfunctioning units and retest as specified above.

3.5 CLEANING

A. Vacuum clean coils and inside of units.

B. Install new filters.

END OF SECTION

SECTION 237223 - PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Energy recovery units.

B. Casing.

C. Fans.

D. Total energy wheel.

E. Filters.

F. Dampers.

G. Vibration isolation.

H. Roof curbs.

I. Power and controls.

J. Accessories.

K. Service accessories.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Division 07 - Thermal and Moisture Protection.

C. Division 09 - Finishes.

D. Section 23 0400 - General Requirements for Mechanical Trades.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.

C. AHRI 1060 I-P - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

D. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

E. ASHRAE Std 84 - Method of Testing Air to Air Heat/Energy Exchangers.

F. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

G. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

J. NFPA 70 - National Electrical Code.

K. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

L. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. See Division 01 - General Requirements.

B. Product Data: Manufacturer's installation instruction, product data, and engineering calculations.

C. Shop Drawings: Show design and assembly of energy recovery unit and installation and connection details.

D. Samples: Submit sample showing custom paint colors.

E. Manufacturer's Qualification Statement.

F. Closeout Submittals: Submit manufacturer's operation and maintenance instructions.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - General Requirements.
   2. Spare Parts: One of each kind of filter.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Firm regularly engaged in manufacturing energy recovery units.
   2. Products in satisfactory use in similar service for not less than five years.
   3. Manufactured and assembled in the United States of America.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in manufacturer's unopened packaging.

B. Store products to be installed indoors in dry, heated area.

1.7 WARRANTY

A. See Division 01 - General Requirements.

B. Warranty ventilator to be free from defects in material and workmanship and of all parts for period of 1-1/2 years from date of Substantial Completion.

C. Warranty energy recovery wheel to be free from defects in material and workmanship for 3 years under circumstances of normal use.

D. Warranty motor to be free from defects in material and workmanship for 7 years under circumstances of normal use.

E. Warranty dessicant core to be free from defects in material and workmanship for 5 years under circumstances of normal use.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Energy Recovery Ventilators:
1. Loren Cook ERV series
2. Greenheck ERV series
3. RenewAire HE series
4. Fantech SER series
5. Substitutions: See Division 01 – General Requirements.

2.2 MINIMUM PERFORMANCE
1. Total Recovery Efficiency: 50 percent, at 95 degrees F (35 degrees C).
2. Apparent Sensible Effectiveness: 75 percent, at 32 degrees F (0 degrees C).
3. Draw through fan arrangement on both sides of the wheel.

2.3 ENERGY RECOVERY UNITS

A. Energy Recovery Units: Dessicant wheel type; prefabricated packaged system designed by manufacturer.
1. Access: Hinged and/or screwed access panels on front.
2. Lifting holes at the unit base.
3. Framing: Welded extruded aluminum tubular frame capable of supporting components and casings.
4. Permanent name plate listing manufacturer mounted inside door near electrical panel.

2.4 CASING

A. Wall, Floor, and Roof Panels:
1. Panels: Removable.
2. Construction: 1 inch thick, double wall box construction, with formed edges of exterior wall overlapping formed edges of interior wall.
3. Aluminum is standard. Factory-painted aluminized steel is an economic alternative when the higher corrosion resistance of aluminum is not required.
4. Exterior Wall: Galvanized steel sheet.

a. 20 gage, 0.0359 inch galvanized steel.
b. 0.040 inch thick aluminum.
c. Color: Gray.

5. Interior Wall: Galvanized sheet metal.
   a. 20 gage, 0.0359 inch aluminized steel.
   b. 22 gage, 0.0299 inch galvanized sheet metal.
6. Insulation:
   a. 1/2 inc insulated fiberglass.
   b. Panel Cores: Mineral wool board.
   c. Include antimicrobial protection.
   d. Mold Resistance: "Pass" when tested according to ASTM C1338.
   e. Fungal Resistance: No growth when tested according to ASTM G21.
   f. Bacteria Resistance: No growth when tested according to UL 181.
   g. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84 or UL 723.
   h. Smoke Developed Index (SDI): 50, maximum, when tested in accordance with ASTM E84 or UL 723.
   i. Secure insulation to unit with waterproof adhesive and permanent mechanical fasteners.
7. Roof Panel: Weatherproof.
8. Panel Joints: T-shaped standing seams with overlapping metal caps.
9. Fasteners: Stainless steel.
10. Isolation and Seal: Form continuous, thermally isolated, weather tight seal between inner wall of panels and structural framing with closed cell PVC foam gasketing.
11. Seams: Sealed, requiring no caulking at job site.
12. Coating: Polyurethane enamel.

B. Access Panels: Provide access to components through a large, tightly sealed and easily removable panel.

C. Doors:
1. Construct doors of same construction and thickness as wall panels.
2. Height: 80 inches
3. Hardware:
   a. Hinges: Aluminum.
   b. Corrosion-resistant.
   c. Provide exterior handle and interior 3-point latching device.
   d. Prop Rod: Capable of propping doors in open position.
   e. Wind Restraint: Door chain with spring to absorb force of door swinging open.
   f. Gasket: P-shaped extruded neoprene.
   g. Label each door to identify equipment located within.

D. Trim: 0.08 inches aluminum, continuously welded.

E. Install panels on structural framing with self-tapping stainless steel screws with integral neoprene-backed stainless steel washers.

F. Duct Connection Collars: 0.08 inches (2 mm) aluminum, continuously welded.

G. Weather Hood: Provide on fresh air inlet and exhaust air outlet; removable for access.
1. Construction: ASTM A653/A653M, G90/Z275 galvanized, 20 gage, 0.0359 inch steel sheet.

2. Construction: 0.08 inch thick aluminum with stainless steel fasteners and continuous welding.
3. Screening: Expanded aluminum bird screen.
4. Fresh Air Weather Hood: Maintain a face velocity less than 350 feet/min .

2.5 FANS

A. Provide separate fans for exhaust and supply blowers.

B. Fans:
1. Individually driven with a dedicated motor.
2. Backward inclined.
3. Single width, single inlet.
4. Class 1 aluminum wheels.
5. AMCA-rated.
6. Provide with non-overloading characteristics.
7. Provide non-sparking integral spun steel venturie inlet cones.

C. Bearings:
1. Pillow block.
2. Bearings: Permanently lubricated sealed ball bearings.
3. Rated for not less than 200,000 hours of operation with accessible greased fittings.

D. Housings: 12 gage, 0.1046 inch aluminized steel with plenums integral to general housing and constructed to Class 1 fan standards.

E. Motors:
1. Motors: Open drip proof.
2. Efficiency: High.
3. Speed: Single.
4. Control: Constant Speed.
5. Motor Slide Bases: Removable and adjustable.
6. Fan Motor: Thermal overload protected.
7. Fan Motor: UL listed and labeled.

F. Drives:
1. Fans: Direct Drive [Belt driven].
2. Service Factor: 1.2 (capable).

G. [Belt Guards: Full sized, hinged, painted with high-visibility safety color, and accessible with standard tools.]

2.6 TOTAL ENERGY WHEEL

A. Wheel: Transfer heat and humidity from one air stream to the other with minimum carryover of the exhaust air into the supply air stream.

B. Bypass around Energy Wheel for freeze protection is not allowed.

C. Energy Wheel Media: Cleanable with low temperature steam, hot water or light detergent, without degrading the latent recovery.

D. Wheel Effectiveness: Rated in accordance with ASHRAE Std 84 and AHRI 1060 I-P.

E. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84 or UL 723.

F. Smoke Developed Index (SDI): 50 or less, when tested in accordance with ASTM E84 or UL 723.

G. Energy Recovery Wheel Media Face:
1. Conform to NFPA 90A.
2. Coating: Acid resistant coating.

H. Coat all corrugated surfaces with a thin non-migrating absorbent layer.

I. Wheel Cassette: Easily removable from the unit.

J. Rotor:
1. Type: Non-segmented hygroscopic aluminum wheel.
2. Mounted on permanently lubricated bearings.
3. Rotor Matrix: Corrosion resistant aluminum alloy composed of alternating corrugated and flat, continuously wound layers of uniform widths.
4. Depth: 8 inches.
5. Rotor Wheel: Reinforce with spokes, welded at the hub and perimeter to prevent any uneven run out during normal operations.

K. Desiccant:
1. Type: 3A.
2. Performance:
   a. Desiccant: Non-dissolving, permanent, and resistant to damage from compressed air, low temperature steam, hot water or by vacuum cleaning.
3. Ventilation Factor: 1.00.

L. Pneumatic Seals: Extruded adjustable brush seals.
1. Locations:
   a. Around perimeter of wheel, and mounted perpendicular to face of wheel.
   b. Separation between exhaust and supply air streams on both sides of wheel.
2. Pressure Differential: Adjustable by means of a lockable quadrant operator.

M. Drive:
1. Drive: Tensioned drive with full perimeter link style belt.
2. Inertial Shock Absorber: Absorb start and stop inertial shock to gear reducer.
3. Select above or below depending on type of motor required.

N. [Purge Angle:
1. Purge Angle: Field adjustable from zero to six degrees of rotor circumference arc to suit the prevailing pressure conditions.
2. Divert sufficient supply air to accomplish full purging of exhaust-air from energy wheel to achieve no cross contamination.]

O. [Wheel Rotation Detection:
1. Turn off energy recovery unit if improper rotor rotation is detected.
2. Send alarm to Building Management System if rotation is not detected or belt is slipping.
3. Retain the following when calculations indicate frost could form on energy wheel. Note that frost control is not required when using variable frequency drive motors on wheel.]

2.7 FILTERS

A. Final Filter on Fresh Air Stream: 13 MERV.

B. Exhaust and Fresh Air Streams: MERV 7 filters constructed to meet ASHRAE Std 52.2.

C. Filter Removal Hooks: Provide means to remove filters that are not immediately accessible from exterior of unit

D. Provide spare set of filters.

2.8 DAMPERS

1. Damper Capacity: Demonstrate damper capacity to withstand HVAC system operating conditions.
   a. Closed position: 6 inches w.g.
   b. Open position: 3000 feet per minute.
2. Fabrication:
   a. Frame: 20 gage, 0.0359 inch 3 inch roll formed galvanized steel channel with rear flange, prepunched mounting holes, and welded corner clips for maximum rigidity.
   b. Blades:
      1) Style: Single-piece, overlap frame.
      2) Material: Roll formed 28 gage, 0.0149 inch galvanized steel.
      3) Width: Maximum 6 inches.
   c. Blade Seals: Extruded vinyl, mechanically attached to the blades edge.
   d. Linkage: Galvanized steel tie bar with stainless steel pivot pins mounted on blades.
   e. Axles: Stainless steel.
   f. Mounting: Vertical.
   g. Finish: Mill galvanized.

B. Return Air Damper:
1. Factory installed, adjustable volume control, opposed blade damper for regulating airflow, based on external static pressure.
2. Conceal linkage out of air stream, within damper frame to reduce pressure drop and noise and lessen need for maintenance.
3. Form from single piece of minimum 16 gage, 0.0598 inch galvanized steel.
4. Return Air Damper: Structural hat channels, reinforced at corners.
5. Roll-formed Frames: Structurally superior to 13 gage, 0.0897 inch U-channel frames.
6. Blades: Single skin, 16 gage, 0.0598 inch.
7. Bearings: Corrosion resistant, molded synthetic sleeve type turning in extruded hole in damper frame.

C. Return Air Inlets: Provide expanded metal grating in welded frame to prevent items larger than 1/2 inch in diameter from falling into ducts below.

D. Motorized Dampers: Provide motorized dampers at outside air inlet, exhaust air outlet, and supply air outlet.
1. Type: Motorized two position parallel blade damper with blade seals.
2. Motorized Damper: Roll-formed structural hat channels, reinforced at the corners,
3. Formed from single piece of minimum 16 gage, 0.0598 inch galvanized steel.
4. Blades: Single skin, 16 gage, 0.0598 inch.

5. Blade Edge Seals: PVC coated polyester fabric suitable for minus 25 degrees F to 180 degrees F.
6. Jamb Seals: Flexible stainless, compression type to prevent leakage between end of the blade and the damper frame.
7. Bearings: Corrosion resistant, molded synthetic sleeve type turning in extruded hole in damper frame.
8. Conceal linkage out of air stream, within damper frame to reduce pressure drop and noise and lessen need for maintenance.

2.9 ROOF CURBS

A. Curbs: Provide full perimeter roof curb minimum 18" fabricated from 10 gage, 0.1345 inch aluminized steel.
   1. Curbs: Knock-down type.
   2. Provide flat for roof deck.

B. Isolation Rails: Provide factory-installed, 12 gage, 0.1046 aluminized steel angles top and bottom, connected with flexible, outdoor rated membrane and factory-installed vibration isolation springs.

C. Gaskets: Provide closed cell PVC foam.
   1. Install between top flange of isolation rail and bottom of energy recovery unit.
   2. Install on top of curb.

2.10 POWER AND CONTROLS

A. Motor Control Panels: UL listed.

B. Include necessary motor starters, fuses, transformers and overload protection according to NFPA 70.

C. Provide single-point field connection to power supply.

D. Provide non fused main disconnect integral to control panel.

E. Install wiring in accordance with NFPA 70.

F. Wiring: Enclosed in flexible, liquid tight steel conduit.

2.11 ACCESSORIES

A. Airflow Monitor:
   1. Include integral airflow monitoring station with ability to read both ventilation and exhaust airflow expressed in cu ft/min.
   2. Mount monitor gage on unit exterior and make casing connection watertight.

B. [Rotation Detector:
   1. Equip unit with rotation sensor.
   2. Equip controller with outdoor air temperature sensor that stops energy recovery wheel during moderate temperature periods.
   3. Alarm Contact: 24 volt AC signal suitable for operating a relay.
   4. Provide periodic stop function long enough to promote self-cleaning of wheel but not long enough to induce energy recovery.

5. Allow the energy recovery wheel to be operated in stop mode during very low temperature periods to prevent freezing of wheel while still delivering outdoor air through the unit.]

C. [Electric Preheat Coil:
1. Resistance coil type with elements enclosed in a steel sheath with fins and painted with a baked-on aluminum paint for long life in a 100% fresh air stream.
2. Coil: UL listed and constructed in accordance with NFPA 70 requirements.]

2.12 SERVICE ACCESSORIES

A. [Electrical Receptacle (for Rooftop applications):
1. Provide duplex, ground fault interrupter type receptacle.
2. Provide re-settable circuit breaker in control panel.

B. Switch: 2 type.
1. Two Position Type: Service and operate.
2. Three Position Type: Low, Standby, and Medium.

C. Electrical Components: Factory wired for single point power connection.
1. 60 Hz power connection.
2. Isolate electrical box from the airflow.
3. Protect all integral wires and connections.
4. Electrical Components: UL Listed.
5. Electrical Panel: NEMA 3R mounted on the unit exterior for ease of access.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that structure is ready for installation of unit, that openings in deck for ductwork, if required, are correctly sized and located, and that mechanical and electrical utilities supplying unit are of correct capacities and are accessible.

3.2 INSTALLATION

A. Provide openings for suitable ductwork connection.

B. Outdoor Installations:
1. Roof Panels:
a. Fasteners: Use concealed means of attachment.
b. Minimize penetrations through roof.
c. Provide weather tight seal at required penetrations.
2. Provide drip edge around roof perimeter.
3. Do not locate roof panel joints above doors.

3.3 SYSTEM STARTUP

A. Provide services of manufacturer's authorized representative to provide start up of unit.

3.4 CLEANING

A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

B. See Division 01 - General Requirements.

END OF SECTION

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Air handling unit.
2. Condensing unit.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for concrete foundations specified by this section.
2. Section 23 04 00 – General Conditions for Mechanical Trades
3. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Vibration isolators.
4. Section 23 21 13 - Hydronic Piping: Execution requirements for connection to hot water and drain piping specified by this section.
5. Section 23 22 13 - Steam and Condensate Heating Piping: Execution requirements for connection to steam supply and steam condensate return piping specified by this section.
6. Section 23 23 00 - Refrigerant Piping: Execution requirements for connection to refrigerant piping specified by this section.
7. Section 23 33 00 - Air Duct Accessories: Flexible connections.
8. Section 26 05 03 - Equipment Wiring Connections: Electrical connection to units.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
3. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
4. ARI 365 - Commercial and Industrial Unitary Air-Conditioning Condensing Units.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ASTM International:
1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

D. National Electrical Manufacturers Association:
1. NEMA MG 1 - Motors and Generators.

E. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating:
   1. Cooling and heating capacities.
   2. Dimensions.
   3. Weights.
   4. Rough-in connections and connection requirements.
   5. Duct connections.
   6. Electrical requirements with electrical characteristics and connection requirements.
   7. Controls.
   8. Accessories.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

D. Manufacturer’s Field Reports: Submit start-up report for each unit.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of controls installed remotely from units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.5 QUALITY ASSURANCE

A. Performance Requirements: Energy Efficiency Rating (EER) not less than prescribed by ASHRAE 90.1 when used in combination with compressors and evaporator coils when tested in accordance with ARI 210/240 ARI 340/360.

B. Sound Rating: Measure in accordance with ARI 270.

C. Insulation and adhesives: Meet requirements of NFPA 90A.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum 3 years experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.

C. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

D. Protect units from weather and construction traffic by storing in dry, roofed location.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of condensing units with roof structure

C. Coordinate installation of air handling units with building structure.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five year manufacturers warranty for compressors.

1.10 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance service.

B. Furnish service and maintenance of equipment for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's operating and maintenance data, including filter replacements, fan belt replacement, and controls checkout and adjustments.

C. Furnish 24-hour emergency service on breakdowns and malfunctions for this maintenance period. Furnish capability of response time within 24 hours.

1.11 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Furnish one set for each unit of fan belts (if applicable) and filters.

PART 2 PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING UNITS

A. Manufacturers:
1. The Trane Company
2. Carrier Corp.
3. McQuay International
4. York International
5. Mitsubishi
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Split system consisting of air handling unit and condensing unit including cabinet, evaporator fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, electric heating coil, air filters, controls, air handling unit accessories, condensing unit accessories, and refrigeration specialties.

2.2 AIR HANDLING UNIT

A. Configuration: [As indicated on Drawings.

B. Cabinet:
1. Panels: Constructed of galvanized steel with baked enamel finish. Access Panels: Located on both sides of unit. Furnish with duct collars on inlets and outlets.
2. Insulation: Factory applied to each surface to insulate entire cabinet.

C. Evaporator Fan: Forward curved centrifugal type, resiliently mounted with adjustable belt drive andhigh efficiency motor. Motor permanently lubricated with built-in thermal overload protection.

D. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Factory leak tested under water. Removable, stainless steel, double-sloped drain pan with piping connections on both sides.

E. Refrigeration System: Dual refrigeration circuits controlled by factory installed thermal expansion valve.

F. Electric Heating Coil: Helical nickel-chrome resistance wire coil heating elements with refractory ceramic support bushings easily accessible with automatic reset thermal cut-out, built-in contactors, galvanized steel frame.

G. Air Filters: as noted on the plans. MERV 13 for all air handling units.

H. Air Handling Unit Accessories:
1. Discharge Plenum: with construction and finish matching unit casing. Integral grille of aluminum construction and adjustable louvers.
2. Return Air Grille: mounted in return air opening of aluminum construction and fixed louvers.
3. Mounting Subbase with construction and finish matching unit casing.
4. Vibration Isolators: As specified in Section 23 05 48
5. Field installed ultraviolet C light located upstream of cooling coil.

2.3 CONDENSING UNIT

A. General: Factory assembled and tested air cooled condensing units, consisting of casing, compressors, condensers, coils, condenser fans and motors, and unit controls.

B. Unit Casings: Exposed casing surfaces constructed of galvanized steel with manufacturer's standard baked enamel finish. Designed for outdoor installation and complete with weather protection for components and controls, and complete with removable panels for required access to compressors, controls, condenser fans, motors, and drives.

C. Compressor: Two independent refrigeration circuits resiliently mounted, with positive lubrication, and internal motor overload protection.

D. Condenser Coil: Constructed of copper tubing mechanically bonded to aluminum or copper fins, factory leak and pressure tested.

E. Controls: Furnish operating and safety controls including high and low pressure cutouts. Control transformer. Furnish magnetic contactors for compressor and condenser fan motors. All controls shall have native BACnet interfaces.

F. Condenser Fans and Drives: Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Permanently lubricated ball bearing type motors with built-in thermal overload protection. Furnish high efficiency fan motors.

G. Condensing Unit Accessories: Furnish the following accessories:
1. Controls to provide low ambient cooling to [0] [-20] degrees F.
2. Time delay relay.
3. Anti-short cycle timer.
4. Disconnect switch.
5. Vibration isolators.
6. RAWAL valve
7. Coil with corrosion resistant coating capable of withstanding salt spray test of 10,000 hours in accordance with ASTM B117.
8. Suction and discharge pressure gauges.

H. Refrigeration specialties: Furnish the following for each circuit:
1. Charge of compressor oil.
2. Holding charge of refrigerant.
3. Replaceable core type filter drier.
4. Liquid line sight glass and moisture indicator.
5. Shut-off valves on suction and liquid piping.
6. Liquid line solenoid valve.
7. Charging valve.
8. Oil level sight glass.
9. Crankcase heater.
10. Hot gas muffler.
11. Pressure relief device.

I. Refrigerant: Furnish charge of refrigerant R-410A.

2.4 CONTROLS

A. Furnish interface to Building Automation and Control System.

2.5 CAPACITY

A. Refer to Schedules

2.6 EXECUTION

2.7 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify concrete pad for condensing unit is ready for unit installation.

2.8 INSTALLATION - AIR HANDLING UNIT

A. Install air handling units on vibration isolators. [Refer to Section 23 05 48.]

B. Install floor mounted units on concrete housekeeping pads at least 3-1/2 inches high and 6 inches wider than unit. Refer to Section 03 30 00.

C. Connect air handling units to supply and return ductwork with flexible connections. Refer to Section 23 33 00.

D. Install condensate piping with trap and route from drain pan to condensate drainage system.Install components furnished loose for field mounting.

E. Install connection to electrical power wiring in accordance with Section 26 05 03.

2.9 INSTALLATION - CONDENSING UNIT

A. Install condensing units on vibration isolators. [Refer to Section 23 05 48.]

B. Install units on roof curbs or stands. Refer to plans.

C. Install refrigerant piping from unit to condensing unit. Install refrigerant specialties

D. Evacuate refrigerant piping and install initial charge of refrigerant.

E. Install electrical devices furnished loose for field mounting.

F. Install control wiring between air handling unit, condensing unit, and field installed accessories.

G. Install connection to electrical power wiring in accordance with Section 26 05 03.

2.10 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Requirements for manufacturer’s field services.

B. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

2.11 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. Install new throwaway filters in units at Substantial Completion.

2.12 DEMONSTRATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate air handling unit and condensing operation and maintenance.

2.13 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Do not operate air handling units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 238109 - PACKAGED ROOFTOP AIR CONDITIONING UNITS - LARGE CAPACITY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Packaged rooftop air conditioning unit.
2. Roof curb.

B. Related Sections:
1. Section 23 04 00 – General Conditions for Mechanical Trades
2. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Vibration isolators.
3. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.
4. Section 23 11 26 - Facility Liquid-Petroleum Gas Piping: LP gas piping connections.
5. Section 23 33 00 - Air Duct Accessories: Flexible connections.
6. Section 26 05 03 - Equipment Wiring Connections: Electrical connection to units.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
1. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
2. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

B. Air Movement and Control Association International, Inc.:
1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASTM International:
1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

E. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA MG 1 - Motors and Generators.

F. National Fire Protection Association:
1. NFPA 54 - National Fuel Gas Code.
2. NFPA 58 - Liquefied Petroleum Gas Code.
3. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 DEFINITIONS

A. Energy Efficiency Ratio (EER) - Ratio of net cooling capacity in Btuh to total rate of electric input in watts under designated operating conditions.

B. Integrated Part-Load Value (IPLV): Single-number figure of merit based on part-load EER, COP, or kW/ton expressing part-load efficiency for air-conditioning and heat pump equipment on basis of weighted operation at various load capacities for the equipment.

1.4 SUBMITTALS

A. Division 01 – General Requirements.

B. Product Data: Submit data indicating:
1. Cooling and heating capacities.
2. Dimensions.
3. Weights.
4. Rough-in connections and connection requirements.
5. Duct connections.
6. Electrical requirements with electrical characteristics and connection requirements.
7. Controls.
8. Accessories.

C. Test Reports: Submit results of factory test at time of unit shipment.

D. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

E. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.

F. Manufacturer’s Field Reports: Manufacturer’s Field Reports: Submit start-up report [for each unit].

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of controls installed remotely from units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.6 QUALITY ASSURANCE

A. Cooling Capacity: Rate in accordance with ARI 340/360.

B. Sound Rating: Measure in accordance with ARI 270.

C. Insulation and adhesives: Meet requirements of NFPA 90A.

D. Minimum heating efficiency: In accordance with local Energy Conservation Construction Code.

E. Performance Requirements: Conform to minimum EER and/orIPLV prescribed by ASHRAE 90.1 when tested in accordance with ARI 340/360.

F. Outside Air Damper Leakage: Test in accordance with AMCA 500.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum ten years documented experience.

B. Installer: Company specializing in performing work of this section with minimum ten years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - General Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept units on site. Inspect for damage.

C. Protect units from damage by storing off roof until roof mounting curbs are in place.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of roof curbs with roof structure, roof deck and roof membrane installation.

1.10 WARRANTY

A. Furnish five year manufacturer’s warranty for compressors.

1.11 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance service.

B. Examine unit components [weekly] [semi-monthly] [monthly] [bi-monthly]. Clean, adjust, and lubricate equipment.

C. Include systematic examination, adjustment, and lubrication of unit, including filter replacements, fan belt replacement, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.

D. Perform work without removing units from service during building normal occupied hours.

E. Provide emergency call back service [at all hours] [during working hours] for this maintenance period.

F. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.

G. Perform maintenance work using competent and qualified personnel under supervision [and in direct employ] of manufacturer or original installer.

H. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

1.12 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.

B. Furnish one set of fan belts and filters for each unit.

PART 2 PRODUCTS

2.1 PACKAGED ROOFTOP AIR CONDITIONING UNIT

1. Valent
2. Carrier Corp.
3. Daikin McQuay International
4. The Trane Company
5. York International

B. Configuration:

1. Air delivery: As indicated on Drawings.

C. Identification: Furnish units with decals and tags to indicate caution areas and aid in unit service. Fix unit nameplates to main control panel door. Attach electrical wiring diagrams to control panels.

D. Cabinet, Casing, and Frame:

1. Designed for outdoor installation with weatherproof construction.
2. Frame and unit base: Constructed of galvanized steel. Base overhangs roof curb for water runoff and constructed with formed recess seating on roof curb gasket for positive weather tight seal. Furnish lifting brackets on unit base with lifting holes to accept cable or chain hooks.
3. Modular type design with factory installed blank access sections as indicated on Drawings.
4. Finish: Exterior surfaces finished with baked on enamel paint exceeding 10,000 hour salt spray test in accordance with ASTM B117.
5. Insulation: Minimum of 2 inch thick, [neoprene coated glass fiber secured to panels.
6. Access doors: Hinged. Constructed of galvanized steel insulated double wall construction. Furnish access doors on both sides of each section.

E. Discharge Plenum Section:

1. Duct connections: As indicated on Drawings.

2. Isolation Dampers: Furnish in bottom return and discharge. Furnish two-position, spring return actuator to close when fans are not running.

F. Supply Fan Section:

1. Variable Frequency Drive:
   a. Factory installed in blank access section.
   b. Furnished for supply fan [and return fan].
   c. Factory installed, wired, and tested.
   d. With bypass.
   e. Full digital control.

f. Insulated Gate Bi-Polar Transistors used to produce output pulse width modulation waveform allowing quiet operation.
g. NEMA 250 Type 1 enclosure.
h. Self diagnostics.
i. Proportional-integral-derivative setpoint control.
j. Communication port.
k. Electronic thermal overload protection.

2. Furnish field adjustable duct high limit safety control to protect duct work from excessive duct pressure.

G. Cooling Coil Section:
1. Coil: Constructed of seamless copper tubes mechanically expanded into aluminum fins. Furnish with intertwined circuits with multiple rows. Factory leak tested under water.
2. Drain Pan: Stainless steel, positively sloped extending beyond leaving side of coil and under cooling coil connections. Connect to drain connection extending through unit base. Furnish units with stacked cooling coils with secondary drain pan connected to primary drain pan.
3. Furnish coil with corrosion resistant coating capable of withstanding salt spray test of 10,000 hours in accordance with ASTM B117.]
4. Furnish each compressor with independent refrigeration circuit.
5. Furnish vibration isolators.
6. Furnish vibration eliminators on suction and discharge piping.
7. Furnish short cycle protection.

H. Condensing Section:
1. Condenser coils: Constructed of copper tubing mechanically bonded to aluminum or copper fins. Factory leak tested under water.
2. Condenser fans: Direct drive, propeller type, vertical air discharge. Fan blades constructed of steel. Condenser fan motors [high efficiency] totally enclosed type with internal motor overload protection, three-phase non-reversing type with permanently lubricated ball bearing and integral rain shield.
3. Dehydrate and factory charge [each circuit] with oil and refrigerant.
4. Furnish the following for each circuit:
a. Thermal expansion device.
b. Filter-drier.
c. Replaceable core filter drier.
d. Suction, discharge, and liquid line service valves with gauge ports.
e. Sight glass.
f. High and low pressure safety controls.
g. Liquid line solenoid valve.
h. Sub-cooler circuit to provide 15 degrees of liquid sub-cooling.
i. Hot gas reheat: Factory installed on each refrigerant circuit including hot gas bypass valve, solenoid valve and hot gas bypass piping.

I. Electric Heating Coil Section:
1. Staged elements, constructed with low watt density high nickel-chromium alloy resistance wire, mechanically stacked and heliarc welded to corrosion resistant terminals. Elements supported by corrosion resistant heavy gauge wire rack.
2. Safety controls: Automatic reset high temperature limit control for each heater element with manual reset backup line break protection in each heater element branch circuit.
3. Location: [Downstream] [Upstream] of fan section.

J. Outdoor and Return Air Section:

1. Actuators: Furnish factory installed electric damper actuators for outside air, return air, and exhaust air dampers.
2. Outside Air Damper: fully modulating from 0 to 100 percent outside air with minimum position setting.

K. Exhaust and Relief Air Section:
1. Barometric relief gravity type dampers to operate in conjunction with economizer.
2. Modulating exhaust fans: statically and dynamically balanced, high efficiency motor. Motor permanently lubricated with built-in thermal overload protection. Furnish barometric dampers at fan outlet to prevent backdraft. Fans operated with volume control device based on field adjustable interior space pressure setpoint.

L. Accessories:
1. Convenience Outlet: Factory installed, 115 volt, 15 amp, GFI type, internally mounted.
2. Field installed ultraviolet C light located upstream of cooling coil in coil section.

M. Disconnect Switch: Factory mounted. Non-fused type. Internal to unit or accessible through door.

2.2 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Perform factory test of [each] [representative] unit. Test includes:
1. Dynamic trim balance of completed fan assembly.
2. Complete run check of electrical components and safety controls, including control sequencing.
3. Pressure test, at manufacturer’s rated pressure, of refrigerant coils and condenser coils prior to unit assembly.
4. Leak check of completed refrigerant circuits.
5. Compressor run check.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify roof curbs are installed and dimensions are as shown on shop drawings.

3.2 PREPARATION

A. Furnish roof curbs for installation.

3.3 INSTALLATION

1. Assemble roof curb.
2. Install roof curb level.
3. Coordinate curb installation and flashing roof installer.
4. Install units on roof curb providing watertight enclosure to protect ductwork and utility services.

5. Install gasket material between unit base and roof curb.

B. Install units on vibration isolators. Refer to Section 23 05 48.

C. Connect units to supply and return ductwork with flexible connections. Refer to Section 23 33 00.

D. Install condensate piping with trap and route from drain pan to nearest roof drain.

E. Install components furnished loose for field mounting.

F. Install electrical devices furnished loose for field mounting.

G. Install control wiring between unit and field installed accessories.

3.4 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Requirements for manufacturer’s field services.

B. Furnish services of factory trained representative for minimum of one days to leak test, refrigerant pressure test, evacuate, dehydrate, charge, start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. Install new throwaway filters in units at Substantial Completion.

3.6 DEMONSTRATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate unit operation and maintenance.

END OF SECTION

SECTION 260400 - GENERAL CONDITIONS FOR ELECTRICAL TRADES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. This section applies to certain sections of Division 08 “Openings”, Division 11 “Equipment”, Division 12 “Furnishings”, Division 21“Fire Protection, Division 22 “Plumbing”, Division 23 "Mechanical," Division 27 “Communications”, Division 28 “Electronic safety and Security”, Division 33 “Utilities” and this section applies to all sections of Division 26, "Electrical" of this project specification unless specified otherwise in the individual sections.

C. The Drawings of other trades Architectural, Structural, Landscape, Civil, Mechanical, Fire Protection and Plumbing, Food Service, Communications, and Electronic Safety and Security shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

D. The drawings of equipment suppliers shall be examined for coordination and familiarity of work with Owner’s equipment suppliers.

1.2 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division, (Division 27 and Division 28). Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

C. It is the intent of this Section of the Specifications to establish a standard of quality and performance characteristics for basic materials and installation methods used in building electrical, communications and electronic safety and security systems.

1.3 INTENT

A. This contract is for all labor, materials and equipment required for installation. The system shall be complete and finished in all respects, tested and ready for operation.

Work shall include calibration of equipment with factory settings. All materials, equipment and apparatus shall be new and of first class quality.

B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation as determined by good trade practice even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.

C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section has included the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

E. Location of all existing systems and equipment shown on the plans is based on the best available information. The Contractor shall verify all dimensions and locations of existing systems and equipment in the field and adjust as necessary.

F. Certain items of existing equipment may be indicated for removal or relocation. Items noted for removal shall be disconnected and turned over to the Owner or disposed of by the Contractor if the Owner so requests. If instructed to dispose of items, the Contractor shall remove the items from the premises and dispose of them in a safe, legal and responsible manner and location. Items noted for relocation are intended for reuse in another location as designated on the Drawings. It shall be the responsibility of the Contractor to remove the material from its present location, store the material in a safe place and reinstall the material in its new location. Questions regarding the suitability of the material or equipment shall be brought to the attention of the Owner and Engineer in writing.

G. Wherever a particular piece of equipment, device or material is specifically indicated on the Drawings by model number, type, series or other means, that specification shall take precedence over equipment or materials specified herein. For example: If a particular switch is specified on the Drawings, its specification takes precedence over switch specified herein.

1.4 DEFINITIONS

A. Word “Subcontractor” means specifically the subcontractor working under this Division. Other Contractors are specifically designated “Plumbing Subcontractor”, “General Contractor” and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.

B. Word “install” shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.

C. Words “furnish” or “supply” shall mean purchase, deliver to, and off-load at the job site, all ready to be installed including where appropriate all necessary interim storage and protection.

D. Word “provide” shall mean furnish (or supply) and install as necessary.

E. Word “finished” refers to all rooms and areas scheduled to be painted in Room Finish Schedule on the drawings. All rooms and areas not covered in Schedule, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

F. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

G. Words “approved equal” mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.

H. Word “wiring” shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

I. Word “product” shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

J. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions."

K. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

L. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

M. Approve: The term "approved," where used in conjunction with the Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Engineer's duties and responsibilities as stated in General and Supplementary Conditions.

N. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

O. Remove: The term “remove” means “to disconnect from its present position, remove from the premises and to dispose of in a legal manner.”

P. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

Q. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.5 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)

B. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.

C. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

D. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, higher rating, or higher value shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.

1.6 SURVEYS AND MEASUREMENTS

A. Before submitting his Bid, the Contractors shall visit the site and become thoroughly familiar with all existing conditions under which his work will be installed. This Contract includes all modifications of existing systems required for the installation of new equipment. This Contract includes all necessary offsets, transitions and modifications required to install all new equipment in existing spaces. All new and existing equipment and systems shall be fully operational under this Contract before the job is considered complete. The Contractors shall be held responsible for any assumptions he makes, any omissions or errors he makes as a result of his failure to become fully familiar with the existing conditions at the site and the Contract Documents.

B. 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 the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or which interfere with the intent of the Drawings and Specifications, the Engineer will be notified and work will not proceed until instructions from the Engineer are received.

1.7 CODES AND STANDARDS

A. Reference Standard Compliance

1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

2. Independent Testing Organization Certificate: In lieu of the label or listing, indicated above submit a certificate from an independent testing organization, competent to perform testing, and approved by the engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. The Following Codes and Standards for the state and local jurisdiction where the project is located as listed below apply to all electrical work. Wherever Codes and/or Standards are mentioned in these Specifications, the latest applicable edition or revision shall be followed:

Florida State Building Code Including all Supplements

The International Building Code

The International Mechanical Code

The International Plumbing Code

NFPA 70, the National Electrical Code

Model Energy Code

NECA - 1 Standard for Good Workmanship in Electrical Construction

ASHRAE 90.1 and International Energy Conservation Code

C. The following Standards shall be used where referenced by the following abbreviations:

AIA	American Institute of Architects
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials

EPA	Environmental Protection Agency
FM	Factory Mutual
FSSC	Federal Specification
IEEE	Institute of Electrical and Electronics Engineers
NBS	National Bureau of Standards
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSC	National Safety Council
OSHA	Occupational Safety and Health Administration
UL	Underwriters' Laboratories

D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.8 PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the work, file all necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.9 EQUIPMENT EQUIVALENTS AND SUBSTITUTIONS

A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of workmanship, finish and design that is required. If the Contractors uses an "approved equal" alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.

B. Where one name only is used and is followed by the words “or approved equal”, the Contractor must use the item named or he is required to apply for a substitution. Where one name only is used, the Contractor must use that item named.

C. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.

D. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.

E. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non approved equivalent to that specified and the amount of credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer’s equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

F. If an alternative or substitute item results in a difference in quantity and arrangement of piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.

G. Equipment, material or devices submitted for review as an “equivalent” shall meet the following requirements:

1. The equivalent shall have the same construction features such as, but not limited to:

    a. Material thickness, gauge, weight, density, etc.

    b. Welded, riveted, bolted, etc., construction

    c. Finish, undercoating, corrosion protection

2. The equivalent shall perform with the same or better operating efficiency.

3. The equivalent shall be locally represented by the manufacturer for service, parts and technical information.

4. The equivalent shall bear the same labels of performance certification as is applicable to the specified item, such as UL or NEMA labels.

H. Equipment, material or devices submitted for review as a “substitution” shall meet the following requirements:

1. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.

2. Submit three (3) copies of each request for substitution for consideration.

3. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

   a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.

   b. Samples, where applicable or requested.

   c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.

   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

   f. Cost information, including a proposal of the net change, if any in the Contract Sum.

   g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

   h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time

allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.

i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.

2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.10 SUBMITTAL PROCEDURES

A. Provide Submittals in accordance with the requirements of Division 1 and as indicated in the following.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

1. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will

promptly advise the Contractor when a submittal being processed must be delayed for coordination.

2. If an intermediate submittal is necessary, process the same as the initial submittal.

3. Allow two weeks for reprocessing each submittal.

4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Include the following information on the label for processing and recording action taken.

a. Project name.

b. Date.

c. Name and address of Engineer.

d. Name and address of Contractor.

e. Name and address of subcontractor.

f. Name and address of supplier.

g. Name of manufacturer.

h. Number and title of appropriate Specification Section.

i. Drawing number and detail references, as appropriate.

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

F. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.

G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.

1.11 SHOP DRAWINGS

A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated ductwork layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review copies of all shop drawings to be incorporated in the Electrical Contract. Refer to the General Conditions and Supplementary General Conditions for the quantity of copies required for submission. Where quantities are not specified, provide seven (7) copies for review.

C. Provide shop drawings for all devices specified under equipment specifications for all systems including fire alarm, switchgear, clock, lighting, etc., or where called for elsewhere in the Specifications, or where scheduled on the drawings, or where called out on the drawings. Shop drawings shall include manufacturers' names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures) of all shop drawings, performance cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.

D. Submittals shall be marked with the trade involved, i.e., Electrical, HVAC, Plumbing, Fire Protection, etc. when the submittal could involve more than one trade.

E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.

F. Failure to submit shop drawings in ample time for review shall not entitle the Contractor to an extension of Contract time. No claim for extension by reason of such default will be allowed, nor shall the Contractor be entitled to purchase, furnish and/or install equipment which has not been reviewed by the Engineer.

G. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

H. Acceptance rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not

mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings.

I. Acceptance of shop drawings shall not apply to quantity nor relieve Contractor of his responsibility to comply with intent of Drawings and Specifications.

J. Acceptance of shop drawings is final and no further changes will be allowed without the written consent of the Engineer.

K. Acceptance of shop drawings does not relieve the Contractor from submitting, coordinating and implementing schedules, forms, worksheets and similar as required for owner/operator input and approval as specified herein and required for proper system operation.

L. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

M. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to Bidding to allow for issuance of an Addendum.

N. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

1.12 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 01 Section "PROJECT COORDINATION," to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of electrical 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 of light fixtures, panelboards, conduits, cabinets, etc. Include the following:

2. Clearances for installing and maintaining insulation.

3. Clearances for servicing and maintaining equipment, including NEC requirements and space for equipment disassembly required for periodic maintenance.

4. Equipment connections and support details.

5. Exterior wall and foundation penetrations.

6. Fire-rated wall and floor penetrations.

7. Sizes and locations of required concrete pads and bases.

B. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

D. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

E. Electronic copies of the MEP floor plans are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. If the Contractor elects to obtain the Engineers electronic files an Electronic File Release Form must be submitted with payment. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic File Release Form, and payment, the Engineer will provide copies of the electronic files for the Contractor's use. A copy of the Electronic File Release Form is appended to the end of this specification section

1.13 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, heating, condenser, chilled water piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

E. Where work is installed prior to preparation and approval of the Coordination Drawings or in conflict with the approved Coordination drawings and if so directed in other

Sections, the Contractor indicated shall prepare composite working drawings and sections clearly showing how the work is to be installed in relation to the work of other trades, at no extra charge to the Owner.

1.14 WORKMANSHIP

A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled workmen, journeymen, electricians, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

E. All labor for installation of electrical systems shall be performed by experienced, skilled tradesmen under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, workmanlike manner. The Engineer reserves the right to reject any work which, in his opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.15 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner.

B. The Engineer and the Owner shall be notified in writing of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.16 TEMPORARY UTILITIES

A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

C. First Aid Supplies: Comply with governing regulations.

D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

E. Provide temporary lighting in all areas, throughout construction activities.

1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.

2. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.

a. Except where overhead service must be used, install electric power service underground.

b. Power Distribution System: Install wiring overhead, and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

3. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period.

F. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

G. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.17 PROJECT PHASING

A. Work under each Section shall include all necessary temporary connections, equipment, conduit, wiring, fire alarm equipment and testing, lighting and emergency lighting, fire stopping, connection of necessary mechanical equipment, coordination with utilities, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building or are required to be maintained in a phased fashion during construction shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required to maintain existing systems operational or to accommodate the construction phasing of the project.

1.18 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or workmen and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by workmen or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.19 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer or specified in the contract documents, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct the personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer's recommendations and is operating as intended by the manufacturer. Factory start-up reports shall be included in the operation and maintenance manuals under the appropriate equipment section.

1.20 CLEANING

A. The Contractor shall thoroughly clean all equipment of all foreign substances, oils, dust, dirt, etc., inside and out before final acceptance by the Engineer.

B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. During the course of construction, all conduits shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work.

E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Remove labels that are not permanent labels.

2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces and panelboard interiors.

4. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.

F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material,

skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.

G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

1.21 OPERATING AND MAINTENANCE

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall fully instruct the Owner or the Owner's representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) day notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.

C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

D. An authorized manufacturer's representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. At a minimum, the following equipment will require this inspection: emergency generator, fire alarm system, nurse call system, paging systems, etc. These letters will be bound into the operating and maintenance books.

E. Refer to individual trade Sections for any other particular requirements related to operating instructions.

F. Demonstration shall be recorded on CD Rom with two (2) discs turned over to the Owner.

1.22 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with the requirements of Division 1 and as follows. The Contractor shall prepare six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder.

B. Manual shall include the following:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

5. Emergency instructions.

6. Spare parts list.

7. Copies of warranties.

8. Wiring diagrams.

9. Recommended "turn around" cycles.

10. Inspection procedures.

11. Shop Drawings and Product Data.

12. Equipment start-up reports.

C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, filter quantities and sizes, bearing number, etc. Schedule shall include maintenance to be done and frequency.

D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.

1.23 ACCEPTANCES

A. The equipment, materials, workmanship, design and arrangement of all work installed under the Electrical Sections shall be subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, the Electrical Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Electrical Sections. The intent to use the exact makes specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of the awarding of the Contract. In such instances, deviations may be made pending acceptance by the Engineer or the Owner’s representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to

be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Electrical Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.24 RECORD DRAWINGS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

3. Note related Change Order numbers where applicable.

4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

5. These shall be clearly marked for Record Drawings on a clean set of reproducible paper copies at the completion of the work and turned over to the Owner.

6. Final record documents shall be prepared in the latest Revit version and digital media for all drawings and an accurate Revit model shall be turned over to the Owner at the completion of the work.

1.25 WARRANTIES AND BONDS

A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties are to be included:

1. General close-out requirements included in Section "Project Close-out."

2. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions 02 through 28.

3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.26 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.

1. Refer to individual Sections of Divisions 2 through [16][50] for specific content requirements, and particular requirements for submittal of special warranties.

J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.

3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.27 GUARANTEES

A. The Contractor shall guarantee all material and workmanship under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner.

During this guarantee period, all defects developing through faulty equipment, materials or workmanship shall be corrected or replaced immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineers satisfaction.

B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided

1.28 PROJECT CLOSE-OUT

A. Contractor shall submit annual maintenance proposal to the Architect/Engineer for review and approval as part of the close out documents.

B. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

C. Deliver tools, spare parts, extra stock, and similar items.

D. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

E. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

F. Inspection Procedures: On receipt of a request for inspection, the Engineer will either proceed with inspection or advise the Contractor of unfilled requirements. The Engineer will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Engineer will repeat inspection when requested and assured that the Work has been substantially completed.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

END OF SECTION

Electronic File Release Form

DELIVERY OF ELECTRONIC FILES FOR: _____

Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Client covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Client further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys' fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____ _____

Client's Signature Date

_____

Company - Title

_____ _____

Architects' Signature Date

_____

Firm - Title

_____ _____

Owner's Signature Date

_____

Company - Title

SECTION 260501 ELECTRICAL DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This project includes several phases from start to completion. Contractor shall examine the site, existing utilities and existing building and systems and familiarize themselves with the entirety of the project prior to bidding. The existing building will remain in place and operational until the new structure is completed and ready to move operations.

B. Electrical demolition.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements.

B. Section 260400 – General Conditions for Electrical Trades.

C. Division 02 - Existing Conditions

1.3 SUBMITTALS

A. Division 01 – General Requirements.

B. Section 260400 – General Conditions for Electrical Trades.

C. Sustainable Design Documentation: Submit certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. It is the Contractor's responsibility to modify the existing power systems, fire alarm, cable and internet systems in a phased fashion and be maintained outside of the phased area of work. Maintain operation of the existing systems during phased demolition. Devices are to be removed back to the next device outside of the area of work. Extend circuits with wiring to match existing as required to maintain continuity of circuits upstream and downstream of the work affected by phased demolition. Protect existing devices during construction. Take devices off-line if necessary, coordinate bypassing and reactivation of the devices with the Owner.

B. Demolition is to be performed in a selective, phased fashion and performed to maintain existing systems in areas remaining operational. It is the contractor's responsibility to coordinate disruption of systems or circuits and to investigate all circuiting and devices scheduled for removal. Provide temporary measures to maintain existing systems and circuits as required. Refer to phasing plans and coordinate all phasing work with the CM/GC and Owner.

C. Verify field measurements and circuiting arrangements are as shown on Drawings.

D. Verify that abandoned wiring and equipment serve only abandoned facilities.

E. Demolition drawings are based on limited field observation and existing record documents where available.

F. Report discrepancies to Architect/Engineer before disturbing existing installation.

G. Beginning of demolition means installer accepts existing conditions.

H. Contractor shall modify existing circuits, when existing devices are removed, as required to maintain circuit continuity.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate all utility service outages and relocations with utility company and the Owner.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Phased Construction: Provide temporary equipment, wiring, conduit, labor and materials as required to maintain operation of existing systems during all phases of construction.

E. Existing Electrical Services: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 72 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Fire Alarm System: Maintain existing system in service until new system is complete and accepted by the Owner and Local Authorities. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner and local authorities before partially or completely disabling system.
   2. Make notifications at least 72 hours in advance.

G. Existing Telecommunications Systems: Maintain existing systems in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner at least 72 hours before partially or completely disabling system.

2. Notify telephone utility company at least 72 hours before partially or completely disabling system.
3. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Coordinate exact demolition scope with project GC/CM. Should a general demolition contractor be included for all physical demolition activities, electrical contractor shall make-safe all systems, for removal by others. If this demolition activity is assigned to the electrical contractor, and not a general demolition contractor, proceed as follows below and herein.

B. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
2. PCB- and DEHP-containing lighting ballasts.
3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

C. Remove, relocate, and extend existing installations to accommodate new construction.

D. Remove abandoned wiring to source of supply.

E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

G. Disconnect and remove abandoned panelboards and distribution equipment.

H. Disconnect and remove electrical devices and equipment serving equipment to be removed.

I. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

J. Repair adjacent construction and finishes damaged during demolition and extension work.

K. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

A. Division 01 - General Requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Luminaires: Remove existing luminaires indicated for reuse within the project for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, drivers, and broken electrical parts.

END OF SECTION

SECTION 260503 - EQUIPMENT WIRING CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

1.2 RELATED SECTIONS

A. Division 01 – General Requirements

B. Section 260400 – General Conditions for Electrical Trades.

C. All of Division 26,[Division 27], [Division 28] Sections.

1.3 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.4 SUBMITTALS

A. See Division 01 - General Requirements

B. Product Data: Submit device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Provide manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with latest adopted version of applicable building code, including any addendum or supplements.

1.6 CLOSEOUT SUBMITTALS

A. See Division 01- General Requirements

B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.7 COORDINATION

A. See Division 01 - General Requirements

B. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 ATTACHMENT PLUGS

A. Manufacturers:
1. Hubbell.
2. Leviton.
3. Legrand / Pass & Seymour
4. Substitutions: Division 01 - General Requirements.

B. Attachment Plug Construction: Conform to NEMA WD 1.

C. Configuration: NEMA WD 6; match receptacle configuration to outlet furnished for equipment.

D. Rating: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

2.2 FLEXIBLE CORD

A. Manufacturers:
1. General Cable.
2. Southwire Company.
3. Hubbell Incorporated.
4. Substitutions: Division 01 - General Requirements.

B. Cord Construction:
1. Type SO or SJO multi-conductor flexible cord with identified neutral and equipment grounding conductor, suitable for use in damp locations.
2. Rating: 600V [300V], amperage to match full load or MCA rating of equipment being served, sized per NFPA 70, Article 400.5.
3. Conductor Identification:

C. Neutral:
1. White or gray colored braid.
2. Colored tracer in the braid.
3. White, gray, or light blue insulation.
4. Ridges, grooves, or white stripes on the exterior of the cord.

D. Equipment Grounding Conductor:
1. Continuous green color.
2. Continuous identifying marker distinguishing it from the other conductors.

E. Connectors:
1. Type: All steel fitting with gland nut, seal, and bushing for securing cable.

2. Suitable for use for passing cord thru enclosure or bulkhead.
3. Provide with suitable NEMA rating for application.

F. Strain Relief:
1. Type: Aluminum fitting with galvanized steel mesh, duct-tight
2. Suitable for size and type of flexible cord being used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 EXISTING WORK

A. Remove exposed abandoned equipment wiring connections, including abandoned connections above accessible ceiling finishes.

B. Disconnect abandoned equipment and remove wiring connections. Remove abandoned components when connected raceway is abandoned and removed. Install blank cover for abandoned boxes and enclosures not removed.

C. Extend existing equipment connections using materials and methods compatible with existing electrical installations, or as specified.

3.3 INSTALLATION

A. Make conduit connections to equipment using flexible metal conduit. Use liquid tight flexible metal conduit with watertight connectors in damp or wet locations.

B. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

C. Provide receptacle outlet and plate to accommodate connection to attachment plug.

D. Provide flexible cord and cord-cap for field-supplied attachment plug. Coordinate exact requirements with equipment supplier.

E. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

G. Install terminal block jumpers to complete equipment wiring requirements.

H. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

I. Coolers and Freezers: Coordinate the location of openings in freezer and cooler walls, floor, and ceilings with equipment supplier. Seal openings.

J. Install conduit and wiring for interconnection of motorized door operator and motorized fire door control stations, safety devices and accessories to complete equipment wiring requirements.

K. Install conduit and wiring for interconnection of specialty equipment (motorized divider partitions, scoreboards, motorized backboards, shot clocks, motorized shades…etc.) control stations, safety devices and accessories to complete equipment wiring requirements.

L. Install conduit and wiring for interconnection of receptacles, lighting and switches furnished with equipment (fume hoods, food service equipment, furnishings…etc.).

M. Install conduit and wiring for interconnection of alarm initiating devices, control panels and annunciators furnished with equipment.

N. Install conduit and wiring for interconnection of power supplies furnished by other divisions.

O. Install conduit and wiring for interconnection of fire alarm initiating devices, control panels, motors, disconnect switches, and card access equipment and furnished with elevator equipment.

3.4 ADJUSTING

A. See Division 01 – General Requirements.

B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

3.5 EQUIPMENT CONNECTION SCHEDULE

A. Refer to drawings.

END OF SECTION

SECTION 260519 - ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Underground feeder and branch-circuit cable.

C. Metal-clad cable.

D. Power and control tray cable.

E. Manufactured wiring systems.

F. Mineral Insulated Cable (Type M.I.)

G. Wiring connectors.

H. Electrical tape.

I. Heat shrink tubing.

J. Oxide inhibiting compound.

K. Wire pulling lubricant.

L. Cable ties.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements.

B. Division 07 – Thermal and Moisture Protection.

C. Section 260501 – Electrical Demolition : Disconnection, removal, and/or extension of existing electrical conductors and cables.

D. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 283100 - Fire Detection and Alarm: Fire alarm system conductors and cables.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).

D. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2015).

E. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation; 2016.

F. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

G. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.

H. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); Federal Specification; Revision A, 2008.

I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

J. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable; 2012.

K. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.

L. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

O. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

P. UL 183 - Manufactured Wiring Systems; Current Edition, Including All Revisions.

Q. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

R. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

S. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

T. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

U. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

V. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

W. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Manufactured Wiring System Shop Drawings: Provide plan views indicating proposed system layout with components identified; indicate branch circuit connections.

E. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Division 01 – General Requirements.
2. Extra Manufactured Wiring System Cable Assemblies: One of each configuration, 6 foot lengths.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Service entrance cable is not permitted, unless noted otherwise.

E. Armored cable is not permitted.

F. Metal-clad cable is permitted as follows:
1. Where not otherwise restricted, may be used:
a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
1) Maximum Length: 6 feet.

b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.

2. In addition to other applicable restrictions, may not be used:
a. Life Safety or Critical Power.
b. Homeruns from first device, such as lighting fixture, MEP equipment, wiring device to panelboards.
c. Where not approved for use by the authority having jurisdiction.
d. Where exposed to view.
e. Where exposed to damage.
f. For damp, wet, or corrosive locations.
g. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.

G. Manufactured wiring systems are permitted only as follows:
1. Where not otherwise restricted, may be used:
a. For branch circuits where concealed under raised floors, where concealed above accessible ceilings for lighting.
1) Exception: Provide single conductor building wire in raceway for circuit homerun from distribution box to panelboard.

H. Mineral Insulated Cable permitted as follows:
1. Rated Feeders requiring a 2-hour protective rating.
2. Fire Alarm and Control Circuits requiring survivability rating.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide conductors and cables with lead content less than 300 parts per million.

D. Provide new conductors and cables manufactured not more than one year prior to installation.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

F. Comply with NEMA WC 70.

G. Comply with FS A-A-59544 where applicable.

H. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

I. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

J. Conductors for Grounding and Bonding: Also comply with Section 260526.

K. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.

L. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

M. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

N. Conductor Material:
1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
   a. Substitution of aluminum conductors for copper is permitted, when approved by Engineer, Owner and authority having jurisdiction, only for the following:
      1) Services: Copper conductors size 1/0 AWG and larger.
      2) Feeders: Copper conductors size 1/0 AWG and larger.
   b. Where aluminum conductors are substituted (if approved and credit applied) for copper, comply with the following:
      1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
      2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
      3) Provide aluminum equipment grounding conductor sized according to NFPA 70.
      4) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, or ASTM B8unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.
4. Aluminum Conductors (only where specifically indicated): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

O. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
   a. Exceptions:
      1) 20 A, 120 V circuits longer than 75 feet 10 AWG minimum, and sized for voltage drop.
      2) 20 A, 120 V circuits longer than 150 feet 8 AWG minimum, and sized for voltage drop.
      3) 20 A, 277 V circuits longer than 150 feet: 10 AWG minimum, and sized for voltage drop.
2. Control Circuits: 14 AWG.

P. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

Q. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
a. 480Y/277 V, 3 Phase, 4 Wire System:
1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.
b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.
c. 240/120 V, 1 Phase, 3 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Neutral/Grounded: White.
d. Equipment Ground, All Systems: Green.
e. Isolated Ground, All Systems: Green with yellow stripe.
f. Travelers for 3-Way and 4-Way Switching: Pink.
g. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
h. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
a. Cerro Wire LLC.
b. Southwire Company
c. General Cable Technologies
d. Substitutions: See Section 01 - Product Requirements.
2. Aluminum Building Wire (only where specifically indicated):
a. Encore Wire Corporation
b. Southwire Company
c. Stabiloy, a brand of General Cable Technologies Corporation
d. Substitutions: See Section 01 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      a. Installed Underground: Type XHHW-2.
   2. Aluminum Building Wire (only where specifically indicated): Type XHHW-2.

2.4 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A. Manufacturers:
   1. Cerro Wire LLC.
   2. Encore Wire Corporation.
   3. Southwire Company.
   4. General Cable Technologies.
   5. Substitutions: See Section 01 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Provide equipment grounding conductor unless otherwise indicated.

D. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

E. Insulation Voltage Rating: 600 V.

F. Insulation: Type XHHW-2.

2.5 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc.
   2. Encore Wire Corporation
   3. Southwire Company
   4. General Cable Technologies
   5. Substitutions: See Section 01 - Product Requirements.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide oversized neutral conductors where indicated or required.

G. Provide dedicated neutral conductor for each phase conductor where indicated or required.

H. Grounding: Full-size integral equipment grounding conductor.
   1. Provide additional isolated/insulated grounding conductor where indicated or required.

I. Armor: Steel, interlocked tape.

J. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.6 POWER AND CONTROL TRAY CABLE

A. Manufacturers:
   1. Encore Wire Corporation: www.encorewire.com.
   2. Okonite: www.okonite.com.
   3. Southwire Company: www.southwire.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.

C. Where exposed run cable is indicated between cable tray and utilization equipment in qualifying industrial establishments as determined by authorities having jurisdiction, provide tray cable marked as Type TC-ER in accordance with NFPA 70.

D. Conductor Stranding: Stranded.

E. Insulation Voltage Rating: 600 V.

F. Insulation: Type XHHW or XHHW-2.

G. Grounding: Full-size integral equipment grounding conductor.

H. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.7 MINERAL INSULATED CABLE (TYPE M.I.)

A. Rating: M.I. cables shall be U.L. Listed and rated for 2 hours fire resistivity.

B. Handling: Cables shall be installed, stored, prepared, and terminated per manufacturer's requirements.

C. Splices: Splices shall be performed by manufacturer's representative or certified personnel trained in proper termination techniques.

D. Supports: Provide cable supports at 3'-0" max. horizontally, 6'-0" max. vertically. Anchors shall be steel.

E. Configuration: Single conductors run together to form multi-phase feeders shall be installed in a tri-foil configuration. All sheaths shall maintain contact with each other until entering into termination enclosure. Provide stainless steel straps to form bundles. Straps shall be installed at 3'-0" max. horizontal and vertical runs.

F. Sheath material: Seamless soft-drawn copper.

G. Lugs: Cables shall terminate on approved lugs.

H. Manufacturers: Pyrotenax/Pentair.

2.8 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 260526.

C. Wiring Connectors for Splices and Taps:
1. Copper conductors 10 AWG and smaller: Install insulated spring wire connectors with plastic caps
2. Copper Conductors Size 8 AWG: Install solderless pressure connectors with insulating covers
3. Copper Conductors Size 6 AWG and larger: Install pressure connectors or split bolt connectors.
4. Connectors for Aluminum Conductors: Use compression connectors.

D. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Aluminum Conductors: Use compression connectors for all connections.
7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
8. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
1. Manufacturers:
a. 3M
b. Ideal Industries, Inc.
c. NSI Industries LLC.
d. Ilsco
e. Erico

f. Substitutions: See Division 01 – General Requirements.

H. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
a. Burndy LLC.
b. Ilsco
c. Thomas & Betts Corporation
d. Substitutions: See Division 01 – General Requirements.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
1. Manufacturers:
a. Burndy LLC.
b. Ilsco
c. Thomas & Betts Corporation
d. Erico
e. Substitutions: See Division 01 – General Requirements.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
1. Manufacturers:
a. Burndy LLC.
b. Ilsco
c. Thomas & Betts Corporation
d. Substitutions: See Division 01 – General Requirements.

2.9 WIRING ACCESSORIES

A. Electrical Tape:
1. Manufacturers:
a. 3M
b. Plymouth Rubber Europa
c. Substitutions: See Division 01 – General Requirements.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F .
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
1. Manufacturers:
a. 3M
b. Burndy LLC.
c. Thomas & Betts Corporation
d. Substitutions: See Division 01 – General Requirements.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
   1. Manufacturers:
      a. Burndy LLC.
      b. Ideal Industries, Inc.
      c. Ilsco
      d. Substitutions: See Division 01 – General Requirements.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
   1. Manufacturers:
      a. 3M
      b. American Polywater Corporation
      c. Ideal Industries, Inc.
      d. Substitutions: See Division 01 – General Requirements.

E. Cable Ties: Material and tensile strength rating suitable for application.
   1. Manufacturers:
      a. Burndy LLC.
      b. Substitutions: See Section 01 - Product Requirements.
   2. Provide plenum rated cable ties.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as shown on the drawings.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated and routing is not shown, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.

5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is not permitted where indicated:
    a. Dedicated neutral conductors are considered current-carrying conductors.
    b. Increase size of conductors as required accounting for ampacity derating.
    c. Size raceways, boxes, etc. to accommodate conductors.
7. Common Neutrals: Not allowed.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

I. Terminate cables using suitable fittings.
1. Metal-Clad Cable (Type MC):
    a. Use listed fittings.
    b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
    c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.
    d. Secure at maximum interval of 5 ft.
    e. Install parallel and perpendicular to building lines.
    f. Bundle cables in common routes back to panelboards.

g. Secure from structure using suitable J-hooks or plenum rated cable ties.

J. Install conductors with a minimum of 12 inches of slack at each outlet.

K. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

N. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Do not remove conductor strands to facilitate insertion into connector.
3. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
4. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
   a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
   a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
   b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.

P. Insulate ends of spare conductors using vinyl insulating electrical tape.

Q. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

R. Identify conductors and cables in accordance with Section 260553.

S. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07.

T. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

U. Mineral Insulated Cable Installation:
   1. The wiring and cable shall be installed according to the manufacturers' recommendations, the instructions in the installation and specifications manual and the requirements of the UL Fire Resistance Directory listing.
   2. Provide brass glands, termination kits and fittings from the same manufacturer as the cable. Provide brass plates for entrance fittings to ferrous enclosures per the manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
   1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Ground access wells.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Division 03– Concrete.

C. Division 09 - Finishes.

D. Section 26 0400 – General Conditions for Electrical Trades

E. Section 26 0519 - Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
   1. Includes oxide inhibiting compound.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 4113 –Lightning Protection for Structures.

H. Section 26 5100 - Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code.

F. NFPA 780 - Standard for the Installation of Lightning Protection Systems.

G. UL 467 - Grounding and Bonding Equipment.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. For signal reference grids, coordinate the work with access flooring furnished in accordance with Division 09- Finishes.
4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:
1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Grounding Electrode System:
1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
   a. Provide continuous grounding electrode conductors without splice or joint.
   b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

2. Metal Underground Water Pipe(s):
   a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
   b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
   c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Other Metal Piping:
   a. Provide connection to all metallic gas piping and miscellaneous metal piping of continuous lengths.
   b. Bond in accordance with NFPA 70.
   c. Size bonding conductor in accordance with NFPA 70.
4. Metal In-Ground Support Structure:
   a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
5. Concrete-Encased Electrode:
   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
6. Ground Ring (Counterpoise):
   a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
   b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
   c. Provide ground enhancement material around conductor where indicated.
   d. Provide connection from ground ring conductor to:
      1) Perimeter columns of metal building frame.
      2) Ground rod electrodes located as indicated.
      3) Building service equipment grounding bus..
7. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 22 feet from each other and any other ground electrode.
   c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
   d. Provide ground enhancement material around electrode where indicated.
   e. Provide ground access well for each electrode.
8. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
9. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

10. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
2. Provide equipment grounding conductor routed with supply conductors.
3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

I. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
a. Transformers (except autotransformers such as buck-boost transformers).
b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
c. Generators, when neutral is switched in the transfer switch.
2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between

neutral (grounded) conductors and ground on load side of separately derived system disconnect.

7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

J. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Raceways may be used as sole equipment grounding conductor where permitted by NFPA 70. Provide insulated equipment grounding conductor where indicated or required, including but not limited to:
   a. In each nonmetallic feeder and branch circuit raceway.
   b. In each flexible conduit.
   c. In outdoor portions of each metallic feeder and branch circuit raceway utilizing non-threaded fittings (where permitted) supplying rooftop multi-motor and combination-load air-conditioning and refrigerating equipment.
4. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
5. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
6. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
7. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
8. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
   c. Metal process piping.
9. Provide bonding for interior metal air ducts.
10. Provide bonding for metal building frame.
11. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
12. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
13. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.

K. Isolated Ground System:

1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.
2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.

3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.

L. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

M. Facility Lightning Protection Systems:
1. Do not use grounding electrode dedicated for lightning protection system for component of building grounding electrode system provided under this section.
2. Provide bonding of building grounding electrode system provided under this section and lightning protection grounding electrode system in accordance with NFPA 70 and NFPA 780.

N. Cable Tray Systems: Also comply with Section 26 0536.

O. Pole-Mounted Luminaires: Also comply with Section 26 5100.

P. Static Control Flooring: If required, provide bonding of static control flooring provided in accordance with Section 09 6500.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0519:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).
2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gage of specified conductors.

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
      a. Exceptions:
         1) Use mechanical connectors for connections to electrodes at ground access wells.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
      a. Exceptions:
         1) Use exothermic welded connections for connections to metal building frame.
   4. Manufacturers - Mechanical and Compression Connectors:
      a. Advanced Lightning Technology (ALT)
      b. Burndy LLC.
      c. Harger Lightning & Grounding
      d. Thomas & Betts Corporation
      e. Substitutions: See Division 01 - General Requirements.
   5. Manufacturers - Exothermic Welded Connections:
      a. Burndy LLC.
      b. Cadweld, a brand of Erico International Corporation
      c. ThermOweld, a brand of Continental Industries, Inc.Substitutions: See Division 01 - General Requirements.

D. Ground Bars:
   1. Description: Copper rectangular ground bars with mounting brackets and insulators.
   2. Size: As indicated.
   3. Holes for Connections: As indicated or as required for connections to be made.
   4. Manufacturers:
      a. Advanced Lightning Technology (ALT)
      b. Erico International Corporation
      c. Harger Lightning & Grounding
      d. ThermOweld, a brand of Continental Industries, Inc.
      e. Substitutions: See Division 01 - General Requirements.

E. Ground Rod Electrodes:
   1. Comply with NEMA GR 1.
   2. Material: Copper-bonded (copper-clad) steel.
   3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
   4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
   5. Manufacturers:
      a. Advanced Lightning Technology (ALT)
      b. Erico International Corporation
      c. Galvan Industries, Inc.
      d. Harger Lightning & Grounding
      e. Substitutions: See Division 01 - General Requirements.
      f. .

F. Ground Plate Electrodes:

1. Material: Copper.
2. Size: 24 by 24 by 1/4 inches, unless otherwise indicated.
3. Manufacturers:
   a. Advanced Lightning Technology (ALT)
   b. Erico International Corporation
   c. Harger Lightning & Grounding
   d. ThermOweld, subsidiary of Continental Industries
   e. Substitutions: See Division 01 - General Requirements.

G. Ground Access Wells:
1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
   a. Areas Exposed to Light Vehicular Traffic: Rated for not less than 22,500 pounds vertical design load.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
   a. Round Wells: Not less than 8 inches in diameter.
   b. Rectangular Wells: Not less than 12 by 12 inches.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
4. Cover: Factory-identified by permanent means with word "GROUND".
5. Manufacturers:
   a. Advanced Lightning Technology (ALT)
   b. Erico International Corporation
   c. Harger Lightning & Grounding
   d. ThermOweld, subsidiary of Continental Industries
   e. Substitutions: See Division 01 - General Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree

angle or bury horizontally in trench at least 30 inches deep in accordance with NFPA 70 or provide ground plates.

1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.

E. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

F. Install in accordance with IEEE 142.

G. Install rod electrodes at locations as indicated on Drawings. Install additional rod electrodes to achieve specified resistance to ground.

H. Install grounding and bonding conductors concealed from view.

I. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

J. Install continuous grounding using underground cold water system, driven rods and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

K. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

L. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

M. Permanently attach equipment and grounding conductors prior to energizing equipment.

N. Common Ground Bonding with Lightning Protection System: Bond electric power system, grounding electrode system directly to lightning protection system earth connection at closest point to electric service grounding electrode. Use bonding conductor sized the same as system grounding conductor and install in conduit.

O. Identify grounding and bonding system components in accordance with Section 26 0553.

3.4 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for electrical equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Division 03 - Cast-in-Place Concrete: Concrete equipment pads.

C. Section 260400 – General Conditions for Electrical Trades

D. Section 260533 – Raceway and Boxes for Electrical Systems: Additional support and attachment requirements for conduits.

E. Section 260536 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.

F. Section 265100 - Lighting: Additional support and attachment requirements for interior luminaires.

1.3 REFERENCE STANDARDS

A. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. See Division 01: General Requirements.

B. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components being installed.
   2. Coordinate the work with other trades and provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

C. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Division 03.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualifications: Include evidence of compliance with specified requirements.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with latest adopted version of applicable building code, including any addendum or supplements.

C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

D. Installer Qualifications for Field-Welding: As specified in Section 260400 General Requirements for Electrical Trades.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, fiberglass or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; zinc plated steel.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation
      b. Erico International Corporation
      c. O-Z/Gedney, a brand of Emerson Industrial Automation
      d. Thomas & Betts Corporation
      e. Substitutions: See Division 01 - General Requirements.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
   1. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation
      b. Erico International Corporation
      c. O-Z/Gedney, a brand of Emerson IndustrialAutomation
      d. Thomas & Betts Corporation
      e. Substitutions: See Division 01 - General Requirements.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Comply with MFMA-4.
   2. Channel Material:
      a. Indoor Dry Locations: Use galvanized steel.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
   3. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
   4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
   5. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation
      b. Thomas & Betts Corporation
      c. Unistrut, a brand of Atkore International Inc.
      d. Substitutions: See Division 01- General Requirements.
      e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch diameter.
      b. Busway Supports: 1/2 inch diameter.
      c. Single Conduit up to 1 inch trade size: 1/4 inch diameter.
      d. Single Conduit larger than 1 inch trade size: 3/8 inch diameter.
      e. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
      f. Outlet Boxes: 1/4 inch diameter.
      g. Luminaires: 1/4 inch diameter.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
   4. Hollow Masonry: Use toggle bolts.
   5. Hollow Stud Walls: Use toggle bolts.
   6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
   7. Sheet Metal: Use sheet metal screws.
   8. Wood: Use wood screws.
   9. Plastic and lead anchors are not permitted.
   10. Powder-actuated fasteners may be used with:
      a. Permission by Architect.
      b. Permission by Structural Engineer.
      c. Use only threaded studs; do not use pins.
   11. Hammer-driven anchors and fasteners are permitted as follows:
      a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction (when specified).
      b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction (when specified).
   12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
      a. Comply with MFMA-4.
      b. Channel Material: Use galvanized steel.
      c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch minimum base metal thickness.

d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

13. Manufacturers - Mechanical Anchors:
    a. Hilti, Inc.
    b. ITW Red Head, a division of Illinois Tool Works, Inc.
    c. Powers Fasteners, Inc.
    d. Simpson Strong-Tie Company Inc.
    e. Substitutions: See Division 01 - General Requirements.
14. Manufacturers - Powder-Actuated Fastening Systems:
    a. Hilti, Inc.
    b. ITW Ramset, a division of Illinois Tool Works, Inc. Powers Fasteners, Inc.
    c. Simpson Strong-Tie Company Inc.
    d. Substitutions: See Division 01 - General Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated, do not provide support from roof deck.

F. Do not penetrate, notch, or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Division 03.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 26 05 33.

I. Cable Tray Support and Attachment: Also comply with Section 26 05 36.

J. Box Support and Attachment: Also comply with Section 26 05 33.

K. Transformer Supports: Also comply with Section 26 22 00.

L. Luminaire Support and Attachment: Also comply with Section 26 51 00.

M. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

N. Secure fasteners according to manufacturer's recommended torque settings.

O. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Conduit Applications
2. General Requirements
3. Galvanized steel rigid metal conduit (RMC).
4. Intermediate metal conduit (IMC)
5. PVC-coated galvanized steel rigid metal conduit (RMC).
6. Flexible metal conduit (FMC).
7. Liquidtight flexible metal conduit (LFMC).
8. Electrical metallic tubing (EMT).
9. Rigid polyvinyl chloride (PVC) conduit.
10. Liquidtight flexible nonmetallic conduit (LFNC).
11. Non-metallic tubing
12. Surface metal raceway
13. Wireway
14. Boxes
15. Accessories.

B. Related Sections:
1. Section 260503 - Equipment Wiring Connections.
2. Section 260519 – Electrical Power Conductors and Cables.
3. Section 260526 - Grounding and Bonding for Electrical Systems.
4. Section 260529 - Hangers and Supports for Electrical Systems.
5. Section 260534 - Floor Boxes for Electrical Systems.
6. Section 260553 - Identification for Electrical Systems.
7. Section 262726 - Wiring Devices.
8. Section 270533 - Raceway and Boxes for Communications Systems.
9. Section 280533 - Raceway and Boxes for Electronic Safety and Security.

1.2 REFERENCES

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC);

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S);

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A);

D. NECA 1 - Standard for Good Workmanship in Electrical Construction;

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT);

F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit;

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC);

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable;

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit;

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit;

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing;

L. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT);

M. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

N. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

O. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

R. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

S. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

T. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

U. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

V. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

W. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

X. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

Y. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

Z. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

AA. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

BB. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

CC. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

1.3 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for all conduits and fittings outlined in Part 2.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

D. Shop Drawings:
1. Indicate proposed arrangement for conduits to be installed within or under structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

E. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs (where permitted), and conduits 2 inch trade size and larger.

F. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

G. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 – General Requirements.
   2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

D. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

1.8 COORDINATION

A. See Division 01 – General Requirements

B. Coordinate installation of outlet boxes for equipment connected under Section 260503.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

D. Electrical contractor is responsible to fully coordinate with the site and concrete contractors and all other trades when routing conduit underslab. Routing of conduit underslab may be acceptable, provided spacing of conduits is adequate for proper backfilling of area surrounding conduits. Adequate spacing shall mean using factory made conduit spacers that allow for a minimum of 3-inches for backfilling with sand or 3 times the pipe diameter for backfilling with a structural fill. Proposed conduit routing,

installation and methods and backfilling procedures shall be submitted to the Engineer for review prior to installation.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

C. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications listed below. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
   1. Underground:
      a. Under Slab on Grade: Use schedule 40 rigid PVC conduit with galvanized steel rigid metal conduit sweeps. Provide cast metal boxes or nonmetallic handhole. Applications limited to:
         1) Panelboard feeders
         2) Floor boxes
         3) Free-standing equipment
      b. Exterior, Within Trench: Use schedule 40 or schedule 80 rigid PVC conduit with galvanized steel rigid metal conduit sweeps. Provide cast metal boxes or nonmetallic handhole.
      c. Exterior, Concrete Encased: Use Type EB rigid PVC conduit. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   2. Embedded Within Concrete:
      a. Within Slab on Grade: Floor box applications only.
      b. Within Slab Above Ground: Not permitted.
      c. Within Concrete Walls Above Ground: Use Type EB rigid PVC conduit. Provide flush mounted box rated for masonry applications.
   3. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT). Provide flush mounted boxes rated for masonry applications.
   4. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT) or MC cable (where allowed).Provide flush mounted sheet-metal boxes.
   5. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT) or MC cable (where allowed).
   6. Interior, Damp or Wet Locations Provide:
      a. Rigid steel conduit
      b. Intermediate metal conduit
      c. Electrical metallic tubing (EMT) with compression fittings
      d. Schedule 40 PVC conduit
      e. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
   7. Exposed, Interior dry locations: Use electrical metallic tubing (EMT)

8. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
    a. Locations subject to physical damage include, but are not limited to:
        1) Where exposed below 8 feet, except within electrical and communication rooms or closets.
        2) Where exposed below 20 feet in warehouse areas.
        3) _____.
9. Exposed, Exterior: Use galvanized steel rigid metal conduit
10. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit. Use sealing fittings appropriate for classification where installed.
11. Pool chemical exposure: All rooms with potential chemical exposure due to pool treatment agents shall be equipped with PVC conduit and stainless steel hardware.
12. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
    a. Maximum Length: 6 feet.
13. Connections to Vibrating Equipment:
    a. Dry Locations: Use flexible metal conduit or MC Cable.
    b. Damp, Wet, or Corrosive Locations: Use PVC coated liquid tight flexible metal conduit.
    c. Maximum Length: 6 feet unless otherwise indicated.
    d. Vibrating equipment includes, but is not limited to:
        1) Transformers.
        2) Motors.
        3) Pumps.
        4) Fans.
14. Exposed Dry Finished Locations: Provide surface metal raceway and fittings. Unless specified on drawings, requires design team approval for use of surface metal raceway in finished locations. Coordinate all vertical runs of surface raceway with the architect prior to installation.

2.2 GENERAL REQUIREMENTS

A. Fittings for Grounding and Bonding: Also comply with Section 260526.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuits: 3/4 inch trade size.
2. Branch Circuit Homeruns: 3/4 inch trade size.
3. Control Circuits: 1/2 inch trade size.
4. Flexible Connections to Luminaires: 3/4 inch trade size.
5. Underground, Interior: 1 inch trade size.
6. Underground, Exterior: 1 inch trade size.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube and Conduit.
2. Western Tube and Conduit.

3. Wheatland Tube Company.
4. Substitutions: See Division 01 – General Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc.
b. O-Z/Gedney.
c. Thomas & Betts Corporation.
d. Substitutions: See Division 01 – General Requirements
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
5. Do not use die cast zinc fittings.
6. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
1. Allied Tube and Conduit.
2. Western Tube and Conduit.
3. Wheatland Tube Company.
4. Substitutions: See Division 01 – General Requirements.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc
b. O-Z/Gedney, a brand of Emerson Industrial Automation
c. Thomas & Betts Corporation
d. Substitutions: See Division 01 – General Requirements
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded type or compression fittings only.

2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube and Conduit.
2. Western Tube and Conduit.
3. Wheatland Tube Company.
4. Substitutions: See Division 01 – General Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

D. Interior Coating: Urethane, minimum thickness of 2 mil.

E. PVC-Coated Fittings:
1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
6. Interior Coating: Urethane, minimum thickness of 2 mil.

F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.6 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. Carlon Electrical Products.
2. Allied Tube and Conduit.
3. AFC Cable Systems, Inc
4. Substitutions: See Division 01 – General Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
1. Manufacturers:
   a. Bridgeport Fittings Inc
   b. O-Z/Gedney, a brand of Emerson Industrial Automation
   c. Thomas & Betts Corporation
   d. Substitutions: See Division 01 – General Requirements
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
   a. Do not use die cast zinc fittings.

2.7 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. Carlon Electrical Products.
2. Allied Tube and Conduit.
3. AFC Cable Systems, Inc
4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc
b. O-Z/Gedney, a brand of Emerson Industrial Automation
c. Thomas & Betts Corporation
d. Substitutions: See Division 01 – General Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel
a. Do not use die cast zinc fittings.

2.8 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube and Conduit.
2. Western Tube and Conduit.
3. Wheatland Tube Company.
4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
a. Manufacturers:
b. Allied Tube and Conduit.
c. Western Tube and Conduit.
d. Wheatland Tube Company.
e. Substitutions: See Division 01 – General Requirements

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
4. Connectors and Couplings: Use compression (damp or wet location)or set-screw type elsewhere

2.9 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
1. Cantex Inc
2. Carlon, a brand of Thomas & Betts Corporation
3. JM Eagle
4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
1. AFC Cable Systems, Inc
2. Electri-Flex Company
3. International Metal Hose
4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.11 SURFACE METAL RACEWAY

A. Manufacturers:
1. Hubbell Wiring Devices.
2. Thomas & Betts Corp.
3. The Wiremold Co.
4. Substitutions: Division 01 - General Requirements.

B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

C. General:
1. System: Provide surface raceway systems for branch circuit and data network voice, video and other low-voltage wiring. Surface raceway system shall consist of raceway bases, covers, pre-divided raceway bases, dual covers, appropriate fittings and device mounting plates necessary for a complete installation.
2. Configuration: Raceways shall be one- or two-piece design with base and snap-on cover, or three-piece design with base and two snap-on covers which snap side by side on a common base. Base shall be dividable with a fixed barrier for up to 4 compartments. Raceway shall be available in widths of 3/4" to 10" and depths of 17/32" to 5" Provide raceways from a company that can provide custom sizes if required. Raceway covers shall be available in tamper-resistant form with screws on access plates and covers of fittings, but not on standard cover lengths. Raceways shall be multi-piece design with metal base and snap-on metal covers. Assembled base and cover is 5-3/4" wide by 2-1/8" high with a cross section area of 10.06 sq in. Base shall have 2 wiring channels, separated by 1 integral divider, large enough to accept standard power and communication devices without restricting capacity of the adjacent channel. The raceway base shall accept 2 covers that allow separation of services. The cover shall slightly curve and form the raceway sidewall. Provide the base with scored lines to facilitate sectioning of the raceway in 4" increments and include mounting holes,

and tunnel knockouts in the divider wall that will facilitate the crossing over of services.

3. Fittings: Fittings shall include flat, internal and external elbows, couplings for joining raceway sections, wire clips, blank end fittings, and device mounting brackets and plates as applicable. Where required, provide tamper-resistant form, dividable with barriers and matching the size of the accompanying raceway base. Provide full capacity corner elbows and tee fittings to maintain a controlled 2" cable bend radius, meeting the specification for Fiber Optic and UTP cabling and exceeding the TIA/EIA-569-A requirements for communications pathways.
4. Device Brackets and Plates: Provide in sizes to match raceway width and with mounting holes located to ensure proper mounting of devices in up to 4 compartments. Device plates shall be available in any length from 6" to 60", with cutouts to accommodate various combinations of power and communications devices in up to 4 compartments. Provide 6" and 12" long device plates with a flange to overlap the joint of adjacent cover as applicable.
5. Communications Devices and Accessories: Raceway shall accommodate a complete line of connectivity outlets and modular inserts for UTP (including Category 5, 5e, 6) STP (150 ohm) fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting. Where indicated, provide connectivity outlets and modular inserts by Ortronics or approved equal.

D. Classification:
1. Raceway and system components shall be UL and CUL listed.
2. Surface raceways shall be suitable for use in dry interior locations only, as covered in Article 386 (Surface Metal Raceways) 388 (Surface Nonmetallic Raceways) of the National Electrical Code.
3. Surface metal raceways and fittings shall be listed by Underwriters Laboratories under File Number E4376, Listing and Classification Number RJBT and File Number E41751, Listing and Classification Number RJPR respectively.
4. Systems shall comply with UL Standard UL5 for Surface Metal Raceways.
5. Larger 2 and 3 channel non-metallic raceways shall be UL Listed under File Nos. E90378 Guide RJTX and E90377 Guide RJYT, respectively.

E. Surface Mounted Metal Raceways: V700 One-Piece Metal Raceway, G4000 Series Multi-Channel Steel Raceway, V2100 Single-Channel Metal Raceway by The Wiremold Company or approved equal.
1. Material: Galvanized steel, minimum thickness 0.040".
2. Finish: Factory-applied polyester topcoat applied over ivory base suitable for field-applied topcoat, color by Architect.
3. Steel Device Brackets and Plates: Steel overlap device plate for horizontal installation of devices. Plate shall overlap cover to conceal seam.
4. Plastic Overlapping Cover Bracket and Faceplate: Plastic device mounting bracket and trim plate for horizontal installation of devices. Plate shall overlap cover to conceal seam. Faceplate shall accept a variety of power and data/communication devices. Plastic shall be compatible with UL 94 for Plastic.
5. Adjustable Length Raceway Couplings: Provide raceway base sections with adjustable couplings. Each pair of couplings works in conjunction with the raceway base’s scored lines to allow less accurate field cuts. The coupling shall accommodate 4" of lateral movement and facilitate the ability of the raceway to maintain coordination with the wall framing as required. Each coupling shall provide a means of adding supplemental ground screws.

6. Fittings: Fittings shall include flat, internal and external elbows, tees, entrance fittings, wire clips, cover clips, couplings, support clips, and end caps. Covers for fittings shall overlap adjoining raceway covers a minimum of 3/8". Fittings shall be color matched to the raceway. Supply fittings with a base where applicable to eliminate mitering. Provide fittings with adjustable couplings that integrate with the raceway base. Provide a take-off fitting supporting dual services to adapt to existing flush wall boxes and other series of metallic raceways. Fittings shall have provisions to accept tamper resistant fasteners to fully secure the raceway.
   a. Fiber Optic/UTP/STP Fittings: Corner elbows, tees, and entrance end fittings as required to maintain a controlled 2" nominal cable bend radius that meets the specifications for Fiber Optic and UTP/STP cabling and exceeds TIA 569 requirements for communications pathways.
   b. Obstacle Avoidance and Offset Fittings: Provide fittings as required to bypass large and small obstacles and small offsets in supporting wall. Small obstacle avoidance fitting capable of being converted into a takeoff fitting to transition to other metallic raceways.
7. Device Brackets and Plates:
   a. Forward Fittings: Provide device brackets to install single-gang devices horizontally in either channel within the raceway. Provide horizontal device brackets with a single gang face plate. Horizontal device mounting brackets shall be a single piece with integral auxiliary grounding points. Device brackets and activation face plates shall allow the electrical or communications devices to face forward from the sidewall of the raceway.
   b. Communications Devices and Accessories: Raceway shall accommodate a complete line of connectivity outlets and modular inserts for UTP (including Category 5, 5e, 6) STP (150 ohm) fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting. Provide with complete line of preprinted station and port identification labels.

F. Multi-service in wall boxes:
1. Multi-Service In-Wall Boxes: WallSource™ Multi-Service Box by The Wiremold Company or approved equal.
   a. Provide construction box system for bringing power and low voltage devices to one location or to back feed surface wiring systems. System shall consist of in-the-wall boxes, mounting brackets, dividers, device mounting brackets, trim rings, and device plates for a complete installation in accordance with the Drawings.
   b. Material: 0.050" thick galvanized steel with gray or ivory suitable for field painting.
2. Classification and Use: Provide construction box system to be utilized in dry, interior locations only as defined by Article 300-15 of the National Electrical Code, as adopted by the National Fire Protection Association and approved by the American National Standards Institute. The box and system components shall be UL listed in accordance with UL 514A and UL514C. The device mounting bracket shall be molded from color matching UL approved resin.
3. Boxes: Each box shall include the box, dividers and mounting brackets. Dimensions of each shall be a minimum of 32 cubic inches per gang and shall be manufactured of 16-gage minimum thick steel. The box shall accommodate standard power and communication devices.

a. The 2-gang box shall have knockouts located on top and bottom, 2-1/4" from the face to accommodate combinations of 1/2", 3/4", and 1" trade size conduits. Boxes of 4- or 6-gangs shall have knockouts to accommodate 1-1/2" trade size conduits.
b. Box shall have a separate ground terminal provided in each gang.
c. Box shall adjust for a flush installation with the finished wall. There shall be positive stops for surface mounting to 1/2", 5/8", 1" and 1-1/4" thick wallboard. Adjusting screws shall be located outside the box for adjustment prior to installation.

4. Device Mounting Brackets: Self-leveling device mounting bracket shall accommodate standard power devices, connectivity inserts, and Wiremold 5507 series faceplates. Mounting bracket shall be available to accommodate other manufacturer's devices. Mounting bracket shall accommodate six power devices or 18 communications inserts. All faceplates, mounting brackets and trim rings shall be color matched.
5. Communication Devices and Accessories: Box shall accommodate a complete line of connectivity outlets and modular inserts for UTP (including Category 5, 5e, 6) STP (150 ohm) fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting. Where indicated, provide connectivity outlets and modular inserts by Ortronics or approved equal.
6. Fiber Optic/UTP (including Category 5, 5e, 6) Radius: The depth of the box shall accommodate a 1-1/4" cable bend radius, which meets or exceeds the specifications for fiber optic and UTP cabling and TIA/EIA-569A requirements for communications pathways. A 1" controlled radius storage loop shall be available.
7. Device Covers: Device cover plates in the following configurations shall be available: duplex device cover plates, single 1.40" and 1.59" diameter receptacle cover plates, switch plates, GFCI cover plates, Sentrex surge receptacle cover plates and other rectangular faced plates. Single gang cover plates shall be modular in design.
8. Support Bracket: Provide support bracket for mounting on 16" on center studs on boxes with more than two gangs.
9. Dividers: Dividers shall be removable without any tools.

G. Finish: Architect to select from manufacturers standard color palette.

2.12 WIREWAY

A. Manufacturers:
1. Carlon Electrical Products.
2. Thomas & Betts Corp.
3. Hoffman.
4. Substitutions: See Division 01 – General Requirements

B. Product Description: General purpose or Raintight type wireway.

C. Knockouts: Manufacturer's standard

D. Cover: Screw cover

E. Finish: Rust inhibiting primer coating with gray enamel finish.

F. Poole Equipment Rooms: Provide NEMA 4X Stainless Steel

2.13 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Manufacturers:
   a. Cooper Crouse-Hinds, a division of Eaton Corporation
   b. Hubbell Incorporated; Bell Products
   c. Hubbell Incorporated; RACO Products
   d. Leviton
   e. O-Z/Gedney, a brand of Emerson Industrial Automation
   f. Thomas & Betts Corporation
   g. Substitutions: See Division 01 – General Requirements
2. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
3. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
4. Use cast iron boxes or cast aluminum boxes with threaded hubs where exposed galvanized steel rigid metal conduit is used.
5. Use cast aluminum boxes with threaded hubs where aluminum rigid metal conduit is used.
6. Use nonmetallic boxes where exposed rigid PVC conduit is used.
7. Use suitable concrete type boxes where flush-mounted in concrete.
8. Use suitable masonry type boxes where flush-mounted in masonry walls.
9. Use raised covers suitable for the type of wall construction and device configuration where required.
10. Use shallow boxes where required by the type of wall construction.
11. Do not use "through-wall" boxes designed for access from both sides of wall.
12. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
13. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
14. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
15. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
16. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
17. Minimum Box Size, Unless Otherwise Indicated:
   a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep trade size.

b. Communications Systems Outlets:
   1) Minimum 4 inch square by 2-1/8 inch trade size.
   2) Provide with single-gang drywall ring.
   3) Comply with Section 27 0533.
c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep trade size.

18. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches :
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
   a. Indoor Clean, Dry Locations: Type 1, painted steel.
   b. Outdoor Locations: Type 3R, painted steel.
   c. Pool Equipment Rooms: Use Stainless Steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches :
   a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
   b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
   a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
   b. Back Panels: Painted steel, removable.
   c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
   d. Provide with grounding stud.
   e. Provide with document pocket in cover.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation
   b. Hoffman, a brand of Pentair Technical Products
   c. Hubbell Incorporated; Wiegmann Products
   d. Substitutions: See Division 01 – General Requirements

D. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
1. Manufacturers:
   a. Appleton, a brand of Emerson Industrial Automation
   b. Cooper Crouse-Hinds, a division of Eaton Corporation
   c. Hubbell Incorporated; Killark Products
   d. Substitutions: See Division 01 – General Requirements
2. Provide outlet boxes and sealing fittings that comply with Article 501 of the NEC based on the classification of the area.

E. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.

3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Provide logo on cover to indicate type of service.
5. Applications:
   a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 15 load rating.
   b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 22 load rating.
   c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
   a. Manufacturers:
      1) Hubbell Incorporated; Quazite Products
      2) NewBasis
      3) MacLean Highline
      4) Substitutions: See Division 01 – General Requirements

   b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

2.14 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).

D. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

E. Mechanical Sleeve Seals
1. Manufacturers:
   a. Thunderline Link-Seal, Inc.
   b. NMP Corporation.
   c. PSI Link-Seal.
2. Substitutions: See Division 01 – General Requirements
3. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
4. Use: Provide for all penetrations through foundation walls.

PART 3 EXECUTION

3.1 EXAMINATION

A. See Division 01 – General Requirements.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

C. Verify that field measurements are as shown on drawings.

D. Verify that mounting surfaces are ready to receive conduits.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 260526.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 260529.

C. Identify raceway and boxes in accordance with Section 260553.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

E. Install products in accordance with manufacturer's instructions.

F. Perform work in accordance with NECA 1 (general workmanship).

G. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated and routing is not shown, determine exact routing required.
3. Conceal all conduits unless specifically indicated to be exposed.
4. Unless otherwise approved, do not route conduits exposed:
   a. Across floors.
   b. Across roofs.
   c. Across top of parapet walls.
   d. Across building exterior surfaces.
   e. Interior finished spaces.
5. Conduits installed under slab or embedded in concrete (see section 2.1 where applicable) may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
6. Arrange conduit to maintain adequate headroom, clearances, and access.
7. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
8. Arrange conduit to provide no more than 150 feet between pull points.
9. Route conduits above water and drain piping where possible.
10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.

11. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
12. Maintain minimum clearance of 12 inches between conduits and surfaces exceeding 104 degrees F. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
13. Group parallel conduits in the same area together on a common rack.

H. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
5. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
10. Use of spring steel conduit clips for support of conduits is not permitted.
11. Use of wire for support of conduits is not permitted.

I. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs 6” above finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.

J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.

3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable mechanical sleeve seals where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
9. Provide metal escutcheon plates for conduit penetrations exposed to public view.
10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07 Section 07 8400.

K. Underground Installation:
1. Provide trenching and backfilling in accordance with Division 31.
2. Provide trenching and backfilling in accordance with Division 31.
3. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
   b. Under Slab on Grade:
      1) Minimum 12 inches to bottom of slab.
      2) Depth as required to allow conduit to penetrate perpendicular to slab
4. Provide underground warning tape (exterior below grade) in accordance with Section 260553 along entire conduit length except where concrete-encased.

L. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Division 03 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

M. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

N. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

O. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound

at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.
4. _____.

P. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

Q. Provide grounding and bonding in accordance with Section 260526.

R. Identify conduits in accordance with Section 260553.

S. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.

T. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

3.3 INSTALLATION – BOXES

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Install gang box with plaster ring for single device outlets.

I. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Division 08 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.

a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
b. Communications Systems Outlets: Comply with Section 270533.

4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260534.

J. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 260529.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Install stamped steel bridges to fasten flush mounting outlet box between studs.
5. Install adjustable steel channel fasteners for hung ceiling outlet box.

K. Install boxes plumb and level.

L. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

M. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Division 03.

N. Install boxes as required to preserve insulation integrity.

O. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

P. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

Q. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Provide cast-in-place concrete collar constructed in accordance with Division 03, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
5. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

R. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

S. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.

T. Close unused box openings.

U. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

V. Provide grounding and bonding in accordance with Section 260526.

W. Identify boxes in accordance with Section 260553.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Locate outlet boxes to allow luminaires positioned as indicated on reflected ceiling plan.

B. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.5 ADJUSTING

A. See Division 01 – General Requirements Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

3.6 CLEANING

A. See Division 01 – General Requirements

B. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

C. Clean exposed surfaces and restore finish.

3.7 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 260534 - FLOOR BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes floor boxes; floor box service fittings; poke-through fittings; and access floor boxes.

B. Related Sections:
1. Section 078400 – Firestopping: Firestopping for electrical work.
2. Section 260529 - Hangers and Supports for Electrical Systems: Firestopping for electrical work.
3. Section 260533 - Raceway and Boxes for Electrical Systems.
4. Section 262726 - Wiring Devices: Receptacles for installation in floor boxes.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog data for floor boxes service fittings.

C. Samples: Submit two of each service fitting illustrating size, material, configuration, and finish.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of each floor box and poke-through fitting.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.

PART 2 PRODUCTS

2.1 FLOOR BOXES (Flush floor boxes with or without active devices)

A. Manufacturers:
1. Hubbell
2. Wiremold

3. Thomas and Betts.
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Floor Boxes: NEMA OS 1, 4 inches deep.

C. Adjustability: semi-adjustable.

D. Material: Formed steel or PVC.

E. Shape: To suit application.

2.2 POKE-THROUGH FITTINGS

A. Manufacturers:
1. Hubbell
2. Wiremold
3. Thomas and Betts.
4. Substitutions: Section 01 60 00 - Product Requirements.
5.

B. Product Description: Assembly comprising service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination.

C. Fire Rating: two (2) hours.

D. Service Fitting Type: Flush.

E. Housing: Satin aluminum

F. Device Plate: Satin aluminum

G. Configuration: One duplex and two communications outlets

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify locations of floor boxes and outlets in all areas prior to rough-in.

C. Verify openings in access floor are in proper locations.

3.2 INSTALLATION

A. Boxes and fittings are indicated on Drawings in approximate locations unless dimensioned. Adjust box location to accommodate intended purpose.

B. Floor Box Requirements: Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

C. Set floor boxes level.

D. Install boxes and fittings to preserve fire resistance rating of slabs and other elements, using materials and methods specified in Section 07 84 00.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust floor box flush with finish flooring material.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

END OF SECTION

SECTION 260536 - CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes cable tray.

B. Related Sections:
1. Section 260526 – Grounding and Bonding for Electrical Systems.
2. Section 260529 - Hangers and Supports for Electrical Systems

1.2 REFERENCES

A. ASTM International:
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. National Electrical Manufacturers Association:
1. NEMA VE 1 - Metal Cable Tray Systems.
2. NEMA VE 2 - Metal Cable Tray Installation Guidelines.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.

C. Product Data: Submit fittings and accessories.

D. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual routing of cable tray and locations of supports.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

PART 2 PRODUCTS

2.1 METAL LADDER-TYPE CABLE TRAY

A. Manufacturers:
   1. Cope
   2. B Line
   3. Cablofil

   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA VE 1, ladder type tray.

C. Material: Aluminum.

D. Finish: Natural.

E. Inside Width: As indicated on Drawings.

F. Inside Depth: 3 inches

G. Straight Section Rung Spacing: 9 inches on center.

H. Inside Radius of Fittings: 12 inches

I. Furnish manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

J. Furnish manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install metal cable tray in accordance with NEMA VE 2.

B. Support trays and fasten to structure and finishes in accordance with Section 26 05 29. Install supports at each connection point, at end of each run, and at other points to maintain spacing between supports of four ft maximum.

C. Install firestopping in accordance with Section 07 84 00 or 26 05 29 to sustain ratings when passing cable tray through fire-rated elements.

D. Ground and bond metal cable tray in accordance with Section 26 05 26.
   1. Provide continuity between tray components.
   2. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
   3. Install 2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component.

4. Make connections to tray using mechanical, compression or exothermic connectors.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.2 RELATED REQUIREMENTS (follow the most currently adopted amended version)

A. See Division 01 – General Requirements

B. Division 09 - Finishes.

C. Section 260400 – General Conditions for Electrical Trades.

D. All of Divisions 26, 27 & 28.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

C. NFPA 70 - National Electrical Code.

D. NFPA 70E - Standard for Electrical Safety in the Workplace

E. UL 969 - Marking and Labeling Systems.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.8 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature and humidity is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
a. Switchgear:

1) Identify switchgear name.
2) Identify ampere rating.
3) Identify voltage and phase.
4) Identify power source and circuit number. Include location when not within sight of equipment.
5) Use identification nameplate to identify main and tie devices. Use identification nameplate to identify load(s) served for each branch device, including spares and prepared spaces.
6) See Section 262413 for factory-installed mimic bus.

b. Switchboards:
1) Identify switchboard name.
2) Identify ampere rating.
3) Identify voltage and phase.
4) Identify power source and circuit number. Include location when not within sight of equipment.
5) Use identification nameplate to identify main overcurrent protective device.
6) Use identification nameplate to identify load(s) served for each branch device, including spares and prepared spaces.

c. Motor Control Equipment:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Use identification nameplate to identify main overcurrent protective device.
5) Use identification nameplate to identify load(s) served for each branch device, including spares and prepared spaces

d. Panelboards:
1) Identify panel name.
2) Identify ampere rating.
3) Identify voltage and phase.
4) Identify power source and circuit number. Include location when not within sight of equipment.
5) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
6) Use typewritten circuit directory to identify load(s) served for panelboards with a door, including spares and spaces

e. Transformers:
1) Identify kVA rating.
2) Identify voltage and phase for primary and secondary.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Identify load(s) served. Include location when not within sight of equipment.

f. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

g. Busway:

1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Provide identification at maximum intervals of 20 feet for horizontal runs; 10 feet for vertical runs; minimum of 1 identification label per run.
5) Use identification nameplate to identify load(s) served for each plug-in unit. Include location when not within sight of equipment.

h. Time Switches:
1) Identify load(s) served and associated circuits controlled. Include location.

i. Enclosed Contactors:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
4) Identify coil voltage.
5) Identify load(s) and associated circuits controlled. Include location.

j. Transfer Switches:
1) Identify voltage and phase.
2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.
4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

k. Electricity Meters:
1) Identify load(s) metered.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.
b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

3. Emergency System Equipment:
a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.

4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.

5. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
6. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
7. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
8. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
9. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
10. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
11. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
    a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Division 09.
12. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
    a. Service equipment.
    b. Industrial control panels.
    c. Motor control centers.
    d. Elevator control panels.
    e. Industrial machinery.
13. Arc Flash Hazard Warning Labels: Comply with Section 260573.
14. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
15. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
16. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
17. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
2. Identification for Communications Conductors and Cables: Comply with Section 270553.

3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    a. At each source and load connection.
    b. Within boxes when more than one circuit is present.
    c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
    d. In cable tray, at maximum intervals of 20 feet.
5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
6. Use underground warning tape to identify direct buried cables.

D. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
    a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
        1) Color Code:
            a) Emergency Power System: Red.
            b) Fire Alarm System: Red.
        2) Field-Painting: Comply with Division 09.
        3) Vinyl Color Coding Electrical Tape: Comply with Section 260519.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.
6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

E. Identification for Cable Tray: Comply with Section 260536.

F. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
    a. Color-Coded Boxes: Field-painted in accordance with Division 09 per the same color code used for raceways.
        1) Emergency Power System: Red.
        2) Fire Alarm System: Red.
    b. For exposed boxes in public areas, do not color code.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

a. For exposed boxes in public areas, use only identification labels.

4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

G. Identification for Devices:

1. Identification for Communications Devices: Comply with Section 270553.
2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
3. Factory Pre-Marked Wallplates: Comply with Section 262726.
4. Use identification label to identify fire alarm system devices.
   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
5. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
   a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
6. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
7. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

H. Identification for Luminaires:

1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Manufacturers:
   a. Brimar Industries, Inc.
   b. Kolbi Pipe Marker Co.
   c. Seton Identification Products
   d. Substitutions: Division 01 - General Requirements.
2. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Manufacturers:

a. Brady Corporation
b. Brother International Corporation
c. Panduit Corp.
d. Substitutions: Division 01 - General Requirements.

2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. System designation where applicable:
      1) Emergency Power System: Identify with text "EMERGENCY".
      2) Life Safety Branch: Identify with text "LIFE SAFETY"
      3) Critical Branch: Identify with text "CRITICAL"
      4) Equipment Branch: Identify with text "EQUIPMENT"
      5) Fire Alarm System: Identify with text "FIRE ALARM".
   b. Equipment designation or other approved description.
   c. Other information as indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
   c. Other Information: 1/4 inch.
   d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
5. Color:
   a. Normal Power System: White text on black background.
   b. Emergency Power System: White text on red background.
      1) Life Safety Branch: White text on YELLOW background.
      2) Critical Branch: White text on RED background.
      3) Equipment Branch: White text on GREEN background.
   c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.
   a. Exceptions:
      1) Provide white text on red background for general information or operational instructions for emergency systems.
      2) Provide white text on red background for general information or operational instructions for fire alarm systems.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.

2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
a. Include voltage and phase for other than 120 V, single phase circuits.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.
6.

2.3 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation
2. HellermannTyton
3. Panduit Corp.
4. Substitutions: Division 01 - General Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
1. Do not use self-adhesive type markers.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
1. Do not use handwritten text.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation
2. Brimar Industries, Inc.
3. Seton Identification Products
4. Substitutions: Division 01 - General Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:
1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
a. Emergency Power System: Text "EMERGENCY".
b. Other Systems: Type of service.

F. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:
1. Brady Corporation
2. Brimar Industries, Inc.
3. Seton Identification Products
4. Substitutions: Division 01 - General Requirements.

B. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:
1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 WARNING SIGNS AND LABELS

A. Manufacturers:

1. Brimar Industries, Inc.
2. Clarion Safety Systems, LLC.
3. Seton Identification Products
4. Substitutions: Division 01 - General Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
1. Materials:
a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
a. Do not use labels designed to be completed using handwritten text.
b. Provide polyester overlaminate to protect handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
   1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 12 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 260573 - COORDINATION STUDY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes short circuit and protective device coordination study for the following portions of electrical distribution system from normal power source or sources to and including:
   1. Breakers in service entrance switchboard.
   2. Main breaker in sub-distribution panels.
   3. Main breaker in each panelboard.

1.2 DESIGN REQUIREMENTS

A. Report Preparation:
   1. Perform study with aid of computer software program.
   2. Calculate short circuit interrupting and, when applicable, momentary duties for assumed 3-phase bolted fault short circuit current and phase to ground fault short circuit current at each of the following:

      a. Utility supply.
      b. Switchboards.
      c. Distribution panelboards.
      d. Branch circuit panelboards.
      e. Busway.
      f. Each other significant equipment location throughout system.

B. Prepare time-current curves graphically indicating coordination proposed for system, centered on conventional, full-size, log-log forms.

C. Prepare with each time-curve sheet complete title and one-line diagram with legend identifying specific portion of system covered by that particular curve sheet.

D. Prepare detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

1.3 SUBMITTALS

A. Qualifications Data: Required.

B. Completed Report: Required.

1.4 QUALITY ASSURANCE

A. Use commercially available software, designed specifically for short circuit and protective device coordination studies with minimum of five years documented availability approved by Owner/Engineer.

B. Perform study in accordance with IEEE 242

C. Coordinate work with local power company.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Provide assistance to electrical distribution system equipment manufacturer during start up of electrical system and equipment.

END OF SECTION

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. General Requirements
2. Lighting Contactors
3. Line Voltage Switches
4. Line Voltage Dimmer Switches
5. Switch Plates.
6. Line Voltage Occupancy/Vacancy Sensor Switches
7. Low Voltage Occupancy/Vacancy Sensors
8. Photocells
9. Room Controllers / Power Packs
10. Low Voltage Keypads / Switches.
11. UL 924 Bypass Relays
12. Lighting Control Relay Panels
13. Class 2 Conductors and Cables

B. Related Sections:
1. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.
2. Section 260519– Electrical Power Conductors and Cables.
3. Section 260533 - Raceway and Boxes for Electrical Systems: Product requirements for raceway and boxes for placement by this section.
4. Section 260553 - Identification for Electrical Systems: Product requirements for electrical identification items for placement by this section.
5. Section 262416 - Panelboards.
6. Section 262726 - Wiring Devices: Product requirements for wiring devices for placement by this section.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA FU 1 - Low Voltage Cartridge Fuses.
3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contractors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
4. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.
5. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
6. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
7. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
8. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
9. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2015.

B. 47 CFR 15 - Radio Frequency Devices; current edition.

C. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.

D. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2004 (R2010).

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

I. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

J. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

K. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

M. ASHRAE 90.1 - Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SYSTEM DESCRIPTION

A. IECC (OR ASHRAE 90.1) compliant lighting controls to control all interior and exterior lighting:
   1. Standalone lighting controls in individual spaces consisting of some combination of occupancy sensors, vacancy sensors, photocells, power packs, low voltage switches and low voltage switches with dimming capability.
   2. Standalone microprocessor based controllers with distributed switching control using self-contained individually mounted lighting relays. Provides multiple modes of operation incorporating vacancy sensors, photocells and low voltage control stations.
   3. Lighting control relay panels to control lighting in [corridors, large open areas, stairwells, site lighting, …..]. Incorporates microprocessor local and centralized control, communications modules, bus connected sensors and control stations and power supplies.

B. Refer to lighting control details and riser diagrams on the drawings for additional information.

C. Provide automatic shutoff for lighting inside building, where required. Control shutoff by method conforming to [IECC] OR [ASHRAE 90.1].

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switches with actual installed door swings and sidelights.
3. Coordinate the placement of wall switch occupancy/vacancy sensors with actual installed door swings and sidelights.
4. Coordinate the placement of occupancy/vacancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
5. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
6. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Protect lighting control devices during construction.
2. Clean lighting control devices once final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01 - General Requirements.

B. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.
1. One Line Diagram: Indicating system configuration, panels, number and type of switches or devices.
2. Include typical wiring diagrams for each component.
3. Floor Plan Layout Drawings: Manufacturers symbols are acceptable, provided that symbology between engineer’s device legend and manufacturers symbols are cross-referenced.

C. Product Data: Submit manufacturer’s standard product data for each system component. This shall include, but not be limited to: ratings, configurations, dimensions, sensor coverage ranges, colors, service condition requirements, and installation features.

D. Manufacturer's Installation Instructions: Submit for each system component.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections and evidence that the control schemes identified herein and shown on the typical lighting control details are configured and operational as specified.
1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
2. Provide documentation addressing each room/area control scheme specified with a description of how the submitted system complies.

1.6 CLOSEOUT SUBMITTALS

A. See Division 01 - General Requirements

B. Project Record Documents: Record the following information:
   1. Actual installed locations of components and settings for lighting control devices. Record circuiting and switching arrangements.
   2. Wiring diagrams reflecting field-installed conditions with identified and numbered system components and devices.

C. Operation and Maintenance Data:
   1. Submit replacement parts numbers.
   2. Submit manufacturer's published installation instructions and operating instructions.
   3. Recommended renewal parts list.
   4. Detailed information on device programming and setup.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience. Company shall provide 24/7 telephone support by qualified technicians.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

C. Installer Qualifications: Installer shall be one who is experienced in performing the work of this section, and who has specialized in installation of work similar to that required for this project.

D. Contractor shall ensure that lighting system control devices and assemblies are fully compatible and can be integrated into a system that operates as described in the lighting control notes on drawings and as described within this specification. Any incompatibilities between devices, assemblies, and system controllers shall be resolved between the contractor and the system provider, as required to ensure proper system operation and maintainability.

E. Performance Requirements: Shall provide all system components that have been manufactured, assembled, and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

F. Performance Testing Requirements
   1. Manufacturer shall 100% test all equipment prior to shipment. Sample testing is not acceptable.

G. Code Requirements
   1. System Control Unit and System Field Devices shall be UL listed and certified.
   2. All system components shall be FCC / IC compliant.
   3. All system components shall be installed in compliance with National Electrical Codes.
   4. Building Codes: All units shall be installed in compliance with applicable, local building codes.

1.8 PRE-INSTALLATION MEETINGS

A. See Division 01 - General Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 - General Requirements.

B. Accept components on site in manufacturer's packaging. Inspect for damage.

C. Protect components by storing in manufacturer's containers indoor protected from weather.

1.10 WARRANTY

A. See Division 01 - General Requirements.

B. Furnish five year manufacturer warranty for all components.

1.11 EXTRA MATERIALS

A. See Division 01 - General Requirements Furnish [two] [_____] of each switch type.

B. Furnish [two] [_____] of each occupancy/vacancy sensor type.

C. Furnish [two] [_____] of each photocell type.

D. Furnish [two] [ ] of each [power pack] [load controller] type.

E. Furnish one room controller

PART 2 PRODUCTS

2.1 LIGHTING CONTROL DEVICES – GENERAL REQUIREMENTS

A. Manufacturers:
1. nLight
2. Hubbell
3. Crestron
4. Douglas
5. Substitutions: See Division 01 – General Requirements.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

D. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

E. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

F. Refer to lighting control details on drawings for additional requirements and product specifications.

2.2 LIGHTING CONTACTORS

A. Manufacturers:
1. General Electric
2. Cutler-Hammer
3. Square D
4. Substitutions: See Division 01 – General Requirements

B. Product Description: NEMA ICS 2, magnetic lighting contactor.

C. Configuration: [Electrically held] [Mechanically held, [2] [3] wire control].

D. Coil Operating Voltage: [24] [120] volts, 60 Hertz.

E. Poles: To match circuit configuration and control function.

F. Contact Rating: Conductor overcurrent protection, considering derating for continuous loads.

G. Accessories:
1. Cover Mounted Pilot Devices: NEMA ICS 5, standard-duty Selector Switch: ON/OFF/AUTOMATIC function, with rotary action.
2. Indicating Light: Red Off Green On lens, with LED lamp.
3. Auxiliary Contacts: One field convertible in addition to seal-in contact.
4. Relays: NEMA ICS 2.
5. Control Power Transformers: Provide in each enclosed contactor. Furnish fused secondary.

H. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from [steel finished with manufacturer's standard gray enamel.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.
3. [_____] Locations: Type [_____].

2.3 LINE VOLTAGE SWITCHES

A. Manufacturers:
1. Hubbell Incorporated
2. Leviton Manufacturing Co., Inc.
3. Pass and Seymour/Legrand
4. Substitutions: [Division 01 - General Requirements] [Not Permitted].

B. Line Voltage Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
2. Body and Handle finish: Color selection by Architect.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Lighted Wall Switches: Industrial specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

E. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

F. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

G. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

H. Locking Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed three position switch actuator and momentary contacts; switches keyed alike; single pole double throw, off with switch actuator in center position.

2.4 LINE VOLTAGE DIMMER SWITCHES

A. Manufacturers:
1. Leviton Manufacturing Company, Inc.
2. Lutron Electronics Company, Inc; Maestro Series
3. Pass & Seymour, a brand of Legrand North America, Inc.
4. Substitutions: See Division 01 - General Requirements.

B. Line Voltage Dimmer Switches - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
1. Body and Control finish: Color selection by Architect.

C. Control: Slide control type with separate on/off switch.

D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
1. Incandescent: 600 VA.
2. Magnetic Low-Voltage: 600 VA.
3. Electronic Low-Voltage: 400 VA.
4. Fluorescent: 600 VA.

E. Provide locator light, illuminated with load off.

F. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

G. Refer to plans and lighting fixture schedule for dimming driver/ballast requirements.

2.5 SWITCH PLATES

A. Manufacturers:
1. Hubbell Incorporated
2. Leviton Manufacturing Co., Inc.
3. Pass and Seymour/Legrand
4. Substitutions: [Division 01 - General Requirements] [Not Permitted].
a. Where low voltage keypads / switches or line voltage sensor switches are shown, provide switch plate by same manufacturer.

B. Product Description: Specification Grade.
1. Material: [Plastic] [Stainless steel] [Galvanized steel].
2. Color: By Architect.

2.6 LINE VOLTAGE OCCUPANCY/VACANCY SENSOR SWITCHES

A. Manufacturers: See Paragraph 2.1(A)

B. Product Description: Provide wall switch style occupancy/vacancy sensor capable of turning lights OFF when the space becomes unoccupied and ON when the space becomes re-occupied. Provide with 0-10V dimming capabilities and/or integral daylight control, where indicated on the drawings. Refer to drawings for occupancy or vacancy mode setting.
1. Material: [Plastic] [_____].
2. Color: By Architect.

C. Sensor Switch Requirements:
1. Sensor switch shall be line voltage @ 120/277 VAC, rated for 20A.
2. Sensor technology shall be dual technology: PIR and ultrasonic.
3. Sensor shall have field of view of 180 degrees.
4. Sensor switch shall be capable of operating with LED.
5. Sensor switch shall be set to:
a. Auto-ON, Auto-OFF mode (Occupancy Sensor)
b. Manual-ON, Auto-OFF mode (Vacancy Sensor)
c. Dipswitch selectable to toggle between occupancy and vacancy mode.
6. Sensor shall be capable of turning lights OFF after 20 minutes of inactivity. Switch shall also have 10 and 20 minute overrides.
7. Provide device capable of accepting a 2-wire (hot and neutral) input plus ground.
8. Sensor switch shall be capable of operating in conjunction with a 3-way switch per manufacturers requirements, where indicated on drawings.
9. Provide with 0-10V dimming control.
10. Provide with integral daylight harvesting control: 10-500 foot-candle override range.

2.7 LOW VOLTAGE OCCUPANCY/VACANCY SENSORS

A. Manufacturers: See Paragraph 2.1(A)

B. Product Description: Factory-assembled commercial grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated. Mounting as indicated on floor plans.

C. Sensor Requirements:
1. Sensor Technology:
a. Sensor shall be Dual Technology, unless otherwise noted on drawings. Available sensor technologies:
1) Passive Infrared/Ultrasonic Dual Technology Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
2) Passive Infrared/Acoustic Dual Technology Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
2. Sensor shall be set to:
a. Auto-ON, Auto-OFF mode (Occupancy Sensor)
b. Manual-ON, Auto-OFF mode (Vacancy Sensor)
c. Dipswitch selectable to toggle between occupancy and vacancy mode.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
5. Passive Infrared Lens Field of View: Field customizable to block motion detection in selected areas.
6. Sensor shall be capable of turning lights OFF after 20 minutes of inactivity. Switch shall also adjustable overrides.
7. Sensitivity: Field adjustable.
8. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
9. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
10. Coverage:
a. Small Space (< 500 Sq Ft): 500 square feet minimum
b. Medium Space (500-1000 Sq Ft): 1,000 square feet minimum
c. Large Space (>1000 Sq Ft): 2,000 square feet minimum. Multiple sensors where shown on the plans.
11. Furnish with power pack or room controller by same manufacturer.
a. Provide for zone control and maximum number of sensors connected to power pack per manufacturer's requirements.
b. Provide room controller with functions and quantity of zones as indicated on drawings and as required per manufacturer. Refer to Paragraph 2.9 for additional information.
12. Operation: Silent.

D. Room Sensor Type: As indicated on Drawings.

E. Corridor and Hallway Sensors:
1. Capable of detecting major motion with a long, narrow pattern designed for corridor and aisle sensing. Refer to lighting control details for product specification.

F. High Bay areas: For areas with ceilings more than 15 feet above finished floor, provide high-bay ceiling mounted occupancy sensor. Refer to lighting control details for product specification.

2.8 PHOTOCELLS

A. Manufacturers: See Paragraph 2.1(A)

B. Product Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls. Sensor mounted as indicated on Drawings with separate control-calibration module. Control unit powered by 24 VAC.

C. Control-Calibration Module: Furnish with the following:
1. Capable of being switched between multiple measurement ranges.
2. Separate trip points for high and low response settings.
3. Three-minute time delay between switching outputs to avoid nuisance tripping.

D. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
1. Sensor Type: Photodiode with diffusing lens
2. Sensor Range:
   a. Indoor Photo Sensors: 5 to 100 footcandles (53.8 to 1,080 lx).
   b. Outdoor Photo Sensors: 5 to 250 footcandles (53.8 to 2690 lx).
   c. Atrium Photo Sensors: 200 to 2,500 footcandles (2150 to 2,6910 lx).
   d. Skylight Photo Sensors: 1,000 to 6,000 footcandles (10,760 to 64,580 lx).
   e. Open Loop Photo Sensors: 3 to 6,000 footcandles (32.3 to 64,580 lx).
3. Finish: White unless otherwise indicated.

E. Standalone Dimming Photo Sensors: Photo sensor units with integral 0-10V controller compatible with specified dimming drivers/ballasts, for direct continuous dimming of up to 50 drivers/ballasts.

F. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.

2.9 ROOM CONTROLLERS / POWER PACKS

A. Manufacturers: See Paragraph 2.1(A)

B. Refer to lighting control details on drawings for types, configurations, performance requirements, and additional information.

C. Description: Integrated lighting, dimming, and equipment switching control system for mounting in a concealed space, enclosure shall be plenum rated. Provide pre-configured lighting controller(s), with capabilities for manual setup, and software setup through programming port, configured as a standalone controller.
1. Room Controllers.
2. Power Packs.

D. Dimmable Load Types: 16A per channel at 100 to 277VAC, 50/60 Hz:
1. 0 – 10V LED drivers.

E. Switched Load Types:
1. Fluorescent ballast.
2. Incandescent.

F. Magnetic low voltage.
1. Electronic low voltage.
2. LED

G. General Requirements:
1. Power Packs:
a. Main Power: 100 – 277 VAC, 50/60 Hz.
b. Input/Output (Refer to Drawings and Details for Input/Output Applicable to Project):
1) Line Power Inputs: 1.
2) Switch Channel Outputs: 1 or 2.
3) 0 – 10V Dimmer Outputs: 1 - Class 1 or Class 2.
4) Auxiliary Relay for Interface with Other Systems.
5) Auxiliary Inputs: Hold On/Hold Off as specified.
c. Enclosure: Plenum rated, surface-mounted industrial control enclosure mounts directly to electrical junction box.
2. Room Controllers:
a. Main Power: 100 – 277 VAC, 50/60 Hz.
b. Input/Output (Refer to Drawings and Details for Input/Output Applicable to Project):
1) Line Power Inputs: 1.
2) Switch Channel Outputs: As Indicated on Drawings.
3) 0 – 10V Dimmer Outputs: As Indicated on Drawings. Class 1 or Class 2.
4) Device Bussing, Provide control bussing for the following:
a) Low Voltage Keypads / Switches
b) Photocells / Daylight Sensors
c) Occupancy / Vacancy Sensors
d) Wiring: CAT X, Digital, or per manufacturers requirements.
5) Auxiliary Relay for Interface with Other Systems.
6) Auxiliary Inputs: Hold On/Hold Off as specified.
c. Enclosure: Plenum rated surface-mounted industrial control enclosure.
d. Control Processor:
1) Integrates sensors and other low voltage controls, devices, and subsystems through multiple control interfaces with control network. Refer to drawings for functions and operation required by project.

2.10 LOW VOLTAGE KEYPADS / SWITCHES

A. Provide low voltage keypads / switches with configuration, functionality and operation as indicated on drawings.

B. General Requirements:
1. Custom engravable buttons/switches, refer to drawings for labeling. Refer to Paragraph C below for additional requirements.
2. Quantity and function as indicated on drawings.
3. LED indicators, as shown on drawings.
4. Configured to fit in standard gang boxes.
5. Color: By Architect

C. Labeling:
   1. Provide factory engraved labels for all low voltage keypads / switches buttons.
   2. Refer to lighting control details on drawings for suggested labeling of lighting control equipment. Coordinate naming of scenes/control zones with the Owner. Provide a worksheet listing remote keypad controls, labeling requests and locations to the Owner for their labeling requests.
   3. Do not order labels until Owner coordination is complete.

D. Lighting keypad shall be provided by the same manufacturer as the lighting control system.

2.11 UL 924 BYPASS RELAYS

A. General Requirements:
   1. Refer to drawings and details for required functions.
   2. The UL 924 Bypass Relay shall automatically illuminate connected emergency loads upon utility power interruption, regardless of room switch position. (NEC Article 700)
   3. The UL 924 Bypass Relay shall include an automatic diagnostic, which is initiated when the room switch is turned off. This test procedure will turn the emergency luminaires on for at least 2 seconds, indicating that an emergency power source is available & that the device, ballast, & lamp are all functioning correctly.
   4. Automatic diagnostic shall be approved to meet periodic testing requirements (NEC Article 700 NFPA 101 Chapter 7)
   5. Local room switch, dimmer or lighting keypad shall turn both regular & emergency luminaires on at the same time (no dedicated emergency room switch required).
   6. The UL 924 Bypass Relay shall include a dry contact for 0-10V override during utility power interruption, where indicated on drawings and details.
   7. The UL 924 Bypass Relay shall have a minimum load rating of 20 Amps at 120V or 277V, general use 20 Amps.
   8. The UL 924 Bypass Relay shall accept 120V & 277V 60 Hz Input & Output (voltage tolerance +/- 15%).
   9. The UL 924 Bypass Relay shall include emergency power and regular power indicator LED’s and a manual test switch which are visible to room occupants when installed flush. (UL924 Section 29)
   10. Load contacts shall be able to withstand 10 direct shorts while connected to 20 Amp breaker without permanent damage.
   11. The UL 924 Bypass Relay shall not generate any objectionable electrical or mechanical noise.
   12. The UL 924 Bypass Relay shall mount inside a 4-11/16” junction box with an extension & single gang plaster ring.
   13. The UL 924 Bypass Relay shall be installed flush to the ceiling or above ceiling adjacent to load controlled, such that test switch & LED’s are in plain view of room occupants as required by some local electrical codes.
   14. The UL 924 Bypass Relay shall have UL94-V0 or UL94-5VA flame rating & be approved for installation above the suspended ceiling

2.12 LIGHTING RELAY PANELS

A. Manufacturers: See Paragraph 2.1(A)

B. Product Description: Standalone relay panel with quantity of relays as indicated on drawings. Standalone panel shall utilize a digital controller with LCD screen and numerical keypad.

C. All components are to be supplied by the same manufacturer. The manufacturer shall be a supplier of this type of equipment for over 5 years.

D. Relay Panel shall come pre-assembled complete with Relays, Transformer & Timeclock.

E. Relays mounted in the lighting control panels shall be full load relays suitable for all types of lamp loads up to 20 Amperes. Relays shall be mechanically latching and must have a physical ON/OFF override built into the relay.

F. Time Controls shall be a 365 Day Astronomical Timer for switching, 2-Wire Relays. Programming shall be accomplished by entering data on a membrane key pad with an LCD graphic display. Any output shall be time, astro, photo-controlled or combination photo/time or astro/time controlled. There shall be available up to 500 events per week and 32 holiday programs. The controllers memory and time are not lost when power fails. Programs are held indefinitely and time is held for 72 hours.

G. Provide with inputs for each relay for manual override and programmable control of associated relays or groups of relays.

H. Provide with “BLINK” warning to blink the lights prior to expiration (off control) of a relay or groups of relays via time schedule.
   1. When manual override control is activated relay or relay group shall remain on for up to two hours (programmable).
   2. Relay or groups of relays shall sweep off every two hours until next time scheduled event.

I. Provide manual override low-voltage switches by same manufacturer in locations indicated on drawings.

J. Panel shall be capable of connecting to the building management system via BACNET interface.

K. Panel shall be capable of connecting to the fire alarm system to force all lighting fed through relay panel to 100% brightness.

2.13 CLASS 2 CONDUCTORS AND CABLES

A. General Requirements:
   1. Line Voltage Wiring: Comply with requirements of Division 26 Section "Electrical Power Conductors and Cables".
   2. Class 2 Low-Voltage Cable:
      a. Provide plenum-rated cable.
      b. UTP Cable: CAT 5, CAT 6, or as required by manufacturer:
         1) Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
         2) All cabling shall meet or exceed Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA 568-C.2
         3) Cabling shall use 23AWG minimum conductors.

4) Pulling tension: The cable pulling tension shall not exceed 25 ft/lbs as indicated in TIA/EIA-568-A.

c. Control Cable:

1) Stranded copper cable, Type CMP.

a) Multiple-Conductor.

b) Twisted Pair.

c) Shielded Twisted Pair

d) Minimum AWG: Per manufacturer requirements, as shown on drawings and details.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification:

1. Verify that wiring conditions, which have been previously installed under other sections or at a previous time, are acceptable for product installation in accordance with manufacturer's instruction.
2. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
3. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
4. Verify that final surface finishes are complete, including painting.
5. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
6. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
7. Verify that conditions are satisfactory for installation prior to starting work.

B. Inspection: Inspect all material included in this contract prior to installation. Manufacturer shall be notified of unacceptable material prior to installation.

3.2 EXISTING WORK

A. Remove existing lighting control device wiring, including abandoned wiring above accessible ceilings. Cut cable flush with walls and floors, and patch surfaces.

B. Disconnect and remove abandoned lighting control equipment.

C. Maintain existing to remain lighting control system continuity outside the area of work. Extend existing lighting control system installations using materials and methods compatible with existing.

D. Clean and repair existing lighting control equipment to remain or to be re-installed.

3.3 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.4 INSTALLATION

A. The Electrical Contractor, as part of the work of this section, shall coordinate, receive, mount, connect, and place into operation all equipment. The Electrical Contractor shall furnish all conduit, wire, connectors, hardware, and other incidental items necessary for properly functioning lighting control as described herein and shown on the plans (including but not limited to System Field Devices, 0-10V dimming ballasts, fixed output ballasts, 0-10V LED drivers and communication wire). The Electrical Contractor shall maintain performance criteria stated by manufacturer without defects, damage, or failure.

B. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards, unless otherwise indicated. Install per manufacturer's instructions.

C. Power: The contractor shall test that all branch load circuits are operational before connecting loads to sensor system load terminals, and then de-energize all circuits before installation.

D. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

E. Install wiring in accordance with Section 260519 and paragraph 2.13.

F. Use only properly color coded, stranded wire. Install wire sizes as indicated on Drawings. Install wire in conduit in accordance with Section 260533 and paragraph 2.13.

G. Mount relay panel as indicated on Drawings. Wire numbered relays in panel to control power to each load.

H. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

I. Identify power wiring with circuit breaker number controlling load. When multiple circuit breaker panels are feeding into relay panel, label wires to indicate originating panel designation.

J. Label each low voltage wire with relay number at each switch or sensor. Refer to Section 260553.

K. Coordinate locations of outlet boxes provided under Section 260533 as required for installation of lighting control devices provided under this section.

L. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

M. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.

N. Prior to setting scenes or zones dependent on furniture placement, whiteboard locations, projection screen locations, lectern locations or similar, coordinate with the Owner, Architect and red-lined furniture plans. Make all required adjustments during construction.

O. Systems Integration:
   1. Equipment Integration Meeting:
      a. Facility Representative to coordinate meeting between Facility Representative, Lighting Control System Manufacturer and other related equipment manufacturers to discuss equipment and integration procedures prior to system startup

P. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

Q. Install lighting control devices plumb and level, and held securely in place.

R. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

S. Identify lighting control devices in accordance with Section 260553.

T. Unless otherwise indicated, install power packs/room controllers for lighting control devices within the same space above accessible ceiling or above access panel in inaccessible ceiling.

U. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

3.5 SENSOR INSTALLATION:

A. Adjust sensitivity to cover area installed

B. Set time delay on sensors that are connect to the lighting control system to the minimum. Time delay to off shall be set to no longer than 20 minutes.

C. Provide vacancy sensor configurations as indicated on drawings.

D. Install sensors on vibration free stable surface.

E. Install atrium and skylight light sensor facing toward window or skylight.

F. Install interior light sensor in ceiling facing the floor.

G. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.

H. Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.

I. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors away from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on sensor lenses to block undesired motion detection.

K. Outdoor Photo Sensor Control Locations:
1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
3. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
4. Unless otherwise indicated, set outdoor photo sensor for dusk-to-dawn operation. Lighting shall turn on at dusk / off at dawn.

L. Daylighting Control Photo Sensor Locations:
1. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize control and avoid conflicts or problems affecting proper detection of light levels.
2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.
4. Refer to drawings and details for maintained light level settings.

3.6 MANUFACTURER'S FIELD SERVICES

A. Division 01 - General Requirements.

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 field tests and inspections with the assistance of a factory-authorized service representative:
1. Operational Test: After installing wall stations and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
4. Test outdoor photo controls to verify proper operation, including time delays where applicable. Record test results in written report to be included with submittals.
5. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
6. Adjust relay panel settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings and as-built relay panel schedules in written report, to be included with submittals.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

3.7 FIELD QUALITY CONTROL

A. Division 01 - General Requirements.

B. Inspect each lighting control device for damage and defects.

C. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.8 ADJUSTING

A. Division 01 - General Requirements.

B. Test contactors and switches after installation to confirm proper operation.

C. Confirm correct loads are recorded on directory card in each panel.

D. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.9 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.10 COMMISSIONING

A. Division 01 - General Requirements.

3.11 DEMONSTRATION

A. Division 01 - General Requirements.

B. Demonstrate proper operation of lighting control devices to Architect and Owner, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of four hours of training.
   3. Schedule training with Owner, provide at least 7 days notice to Architect/Engineer of training date.
   4. Instructor: Qualified manufacturer’s representative familiar with the project and with sufficient knowledge of the installed lighting control devices.

END OF SECTION

SECTION 262200 - LOW-VOLTAGE DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General purpose transformers.

1.2 RELATED REQUIREMENTS

A. Division 01 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260534 - Conduit: Flexible conduit connections.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262416 - Panelboards.

1.3 REFERENCE STANDARDS

A. CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers; Current Edition.

B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.

C. IEEE C57.96 - Guide for Loading Dry-Type Distribution and Power Transformers; 2013.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.

F. NEMA ST 20 - Dry-Type Transformers for General Applications; 2014.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.

K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with placement of support framing and anchors required for mounting of transformers.

   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.

   3. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 – General Requirements.

B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
   1. Vibration Isolators: Include attachment method and rated load and deflection.
   2. K-factor Rated Transformers: Include K-factor ratings.
   3. Buck-boost Transformers: Include voltage selection tables and wiring diagrams for autotransformer configurations.
   4. Shielded Transformers: Include shielding method and noise attenuation performance.
   5. Small Power Centers: Include panelboard bus ampacity, integrated short circuit ampere rating, and circuit breaker sizes and ampere ratings.

C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.
   1. Small Power Centers: Include panel arrangements.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Maintenance Data: Include recommended maintenance procedures and intervals.

H. Project Record Documents: Record actual locations of transformers.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
   1. Greater than 10 kVA: 104 degrees F (40 degrees C) maximum.
   2. Less than 10 kVA: 77 degrees F (25 degrees C) maximum.

1.9 WARRANTY

A. See Division 01 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Eaton Corporation.

B. General Electric Company.

C. Schneider Electric; Square D Products.

D. Siemens Industry, Inc.

E. Substitutions: See Division 01 - Product Requirements.

F. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet (1,000 m).
   2. Ambient Temperature:
      a. Greater than 10 kVA: Not exceeding 104 degrees F (40 degrees C).
      b. Less than 10 kVA: Not exceeding 77 degrees F (25 degrees C).

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.3 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Primary Voltage: 480 volts delta, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase.

D. Insulation System and Allowable Average Winding Temperature Rise:
   1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
   2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

E. Coil Conductors: Continuous copper windings with terminations brazed or welded.

F. Winding Taps:
   1. Less than 3 kVA: None.
   2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.

3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

G. Energy Efficiency:
1. Comply with CFR 431, Subpart K.
2. Comply with the Department of Energy 2016 Efficiency Standards.

H. Sound Levels: Standard sound levels complying with NEMA ST 20.
1. 0-9 kVA: 40 dB.
2. 10-50 kVA: 45 dB.
3. 51-150 kVA: 50 dB.
4. 151-300 kVA: 55 dB.
5. 301-500 kVA: 60 dB.
6. 501-700 kVA: 62 dB.
7. 701-1000 kVA: 64 dB.

I. Mounting Provisions:
1. Less than 15 kVA: Suitable for wall mounting.
2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
3. Larger than 75 kVA: Suitable for floor mounting.

J. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor clean, dry locations: Type 1.
   b. Outdoor locations: Type 3R.
2. Construction: Steel.
   a. Less than 15 kVA: Totally enclosed, non-ventilated.
   b. 15 kVA and Larger: Ventilated.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

K. Accessories:
1. Mounting Brackets: Provide manufacturer's standard brackets.
2. Weathershield Kits: Provide for ventilated transformers installed outdoors to provide a listed NEMA 250, type 3R assembly.
3. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.4 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

B. Sound Level Tests: Perform factory test designated in NEMA ST 20 as "design" test on each production unit.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that suitable concrete pads, support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 260534, 2 feet (600 mm) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer.

G. Mount floor-mounted transformers on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Division 03.

H. Mount floor-mounted transformers using vibration isolators suitable for isolating the transformer noise from the building structure.

I. Mount trapeze-mounted transformers using suitable metal framing as recommended by the manufacturer. See Section 260529 for material requirements.

J. Provide seismic restraints where required by local codes.

K. Provide grounding and bonding in accordance with Section 260526.

L. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

M. Where not factory-installed, install lugs sized as required for termination of conductors as shown on the drawings.

N. Where furnished as a separate accessory, install transformer weathershield per manufacturer's instructions.

O. Identify transformers in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Division 01 – General Requirements

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.
   1. 167 kVA single phase, 500 kVA three phase and smaller:
      a. Perform turns ratio tests at all tap positions.
   2. Larger than 167 kVA single phase and 500 kVA three phase:
      a. Verify that control and alarm settings on temperature indicators are as specified.
      b. Perform excitation-current tests on each phase.
      c. Measure the resistance of each winding at each tap connection.
      d. Perform an applied voltage test on all high- and low-voltage windings-to-ground.

3.4 ADJUSTING

A. See Division 01 – General Requirements.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

C. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. See Division 01 – General Requirements.

B. Clean dirt and debris from transformer components according to manufacturer's instructions.

C. Repair scratched or marred exterior surfaces to match original factory finish.

3.6 PROTECTION

A. Protect installed transformers from subsequent construction operations.

END OF SECTION

SECTION 262413 - SWITCHBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements

B. Division 03 - Concrete

C. Section 260400 – General Conditions for Electrical Trades

D. Section 260526 - Grounding and Bonding for Electrical Systems

E. Section 260553 - Identification for Electrical Systems

F. Section 260573 – Overcurrent Protective Device Coordination Study

G. Section 262813 - Fuses

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Current Edition, Including All Revisions.

B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; Current Edition, Including All Revisions.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; Current Edition, Including All Revisions.

D. NECA 400 - Standard for Installing and Maintaining Switchboards; Current Edition, Including All Revisions.

E. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); Current Edition, Including All Revisions.

F. NEMA PB 2 - Deadfront Distribution Switchboards; Current Edition, Including All Revisions.

G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; Current Edition, Including All Revisions.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; Current Edition, Including All Revisions.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

L. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

M. UL 891 - Switchboards; Current Edition, Including All Revisions.

N. UL 977 - Fused Power-Circuit Devices; Current Edition, Including All Revisions.

O. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Service Entrance Switchboards:
1. Coordinate with Electric Utility Company and provide switchboards in compliance with Utility Company requirements and with suitable provisions for electrical service and utility metering, where applicable.
2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
3. Obtain Utility Company approval of switchboard prior to fabrication.
4. Pre-installation Meeting: Convene with Utility Company representative a minimum of two weeks prior to commencing work of this section to review requirements.
5. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.5 SUBMITTALS

A. See Division 01 - General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Submit electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.

C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and front & side elevation views of switchboards and adjacent equipment with overall dimensions shown and all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation of listed series ratings upon request.
   5. Include documentation demonstrating selective coordination upon request.

D. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production tests.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Field Quality Control Test Reports.

H. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - General Requirements.
   2. Enclosure Keys: Two of each different key.
   3. Electronic Trip Circuit Breakers: Provide one portable test set.
   4. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle in accordance with NEMA PB 2.1. Lift only with lugs provided. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

B. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Switchboards

Basis of Design: Schneider Electric; Square D Products
1. Eaton Corporation
2. General Electric Company
3. Siemens Industry, Inc.
4. Substitutions: See Division 01 - General Requirements.

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

C. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Front-Connected Switchboards:
1. Main Device(s): Individually-mounted.
2. Feeder Devices: Panel/group-mounted.
3. Arrangement: Front accessible only (not rear accessible), rear aligned.
4. Gutter Access: Bolted covers.
5. Energy Reduction Maintenance Setting (ERMS) system.
6. Pull Section: as required based on field conditions.
7. Align sections at rear only.

E. Service Entrance Switchboards:
1. Listed and labeled as suitable for use as service equipment according to UL 869A.
2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
3. Comply with Utility Company requirements for electrical service.
4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.

F. Service Conditions:
1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
   a. Altitude: Less than 6,600 feet.
   b. Ambient Temperature:
      1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
      2) Switchboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.
2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
   a. Altitude: Less than 2000 feet.
   b. Ambient Temperature: Between 50 degrees F and 95 degrees F.

G. Short Circuit Current Rating:
1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.

H. Selectivity: Where the requirement for selectivity is required by system and Code, furnish products as required to achieve selective coordination.

I. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

J. Bussing: Sized in accordance with UL 891 temperature rise requirements.
   1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
   2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Phase and Neutral Bus Material: Silver Plated Copper.
   5. Ground Bus Material: Silver Plated Copper.

K. Conductor Terminations: Suitable for use with the conductors to be installed.
   1. Line Conductor Terminations:
      a. Main and Neutral Lug Material: Silver Plated Copper, suitable for terminating aluminum or copper conductors.
      b. Main and Neutral Lug Type: Mechanical.
   2. Load Conductor Terminations:
      a. Lug Material: Silver Plated Copper, suitable for terminating aluminum or copper conductors.
      b. Lug Type:
         1) Provide mechanical lugs unless otherwise indicated.
         2) Provide compression lugs where indicated.

L. Enclosures:
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish: Manufacturer's standard unless otherwise indicated.

M. Future Provisions:
   1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
   2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
   3. Where designated spaces for future device provisions are not indicated, include provisions for minimum of six device(s) rated at ten percent of rating of switchboard main or incoming feed.
   4. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.

N. Surge Protective Device:
   1. Product Description: IEEE C62.41, factory-mounted surge protective device, selected to meet requirements for high exposure (200,000A) and to coordinate with system circuit voltage. integral type 1 surge protection at 480v Y 3 phase with L-N=1200 L-G=1200 N-G=1200 and L-L 2000
   2. Minimum surge current rating per phase: 320 kA.
   3. Surge Protective device module shall be integral to switchboard and shall be fused.

O. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
    a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
    b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
    c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.
3. Furnish monitor panel with lamp to indicate relay operation, TEST and RESET control switches.

P. All circuit breakers rated 1200 amps and above shall have energy reduction maintenance setting (ERMS) system. Provide the following:
1. Energy Reduction Maintenance Setting Switch (ERMS).
    a. Provide a maintenance OFF ON selector switch on the compartment door to switch the circuit breaker instantaneous tripping characteristics to an alternate setting temporarily during maintenance activity.
    b. Provide a lock feature for the ERMS switch so that it may be locked in either the OFF or ON maintenance mode position.
    c. Provide a blue LED indicating light to indicate trip unit is in the ERMS mode.

Q. Phase Failure Relay:
1. Provide integral phase failure relays within switchboard.

R. Instrumentation:
1. Provide power metering equal to a Square D Class 3020 PM8244 PowerLogic Power Meter with display. Device shall be panel mounted in the switchboard. Devices by others will be considered providing all the following specifications are met.
2. The Power Meter shall be equipped with a two (2)-line by sixteen (16)-character LCD display for electrical circuit information.
3. The information displayed by the Power Meter shall include the following quantities:
    a. Current, per-phase
    b. Volts, phase-to-phase & phase-neutral
    c. Real Power (kW), three-phase total
    d. Reactive Power (kVAR), three phase total
    e. Apparent Power (kVA), three phase total
    f. Power Factor, true, per-phase & three-phase total
    g. Frequency
    h. Current Demand, per phase and neutral, present **and peak**
    i. Real Power Demand (kWd), three phase total, present and peak
    j. Reactive Power Demand (kVARd), three phase total, present and peak
    k. Apparent Power Demand (kVAd), three phase total, present and peak
    l. Real Energy (kWh), three phase total
    m. Reactive Energy (kVARh), three phase total
    n. Apparent Energy (kVAh), three phase total
    o. Energy Accumulation Modes, signed, absolute, energy in, energy out
    p. Watt-hour KYZ Pulse Initiator Output
    q. Total Harmonic Distortion, Voltage
    r. Total Harmonic Distortion, Current

s. Date/Time Stamping.

4. Communications port for Power Monitoring Systems communications and Modbus RTU communications.
5. The Power Meter shall be accurate to .25% for voltage and current sensing, .50% for power, energy, & demand sensing, and 1% for power factor sensing.
6. All information stored in the Power Meter shall be remotely accessible through data communications.
7. The Power Meter shall be UL Listed, rated for an operating temperature range of 0C to 55C and have an overcurrent withstand rating of 500 amps for 1 second.
8. The Power Meter metering inputs shall utilize industry standard current transformers (5A secondary CT's), have VT inputs for direct connection of VT leads to up to 600V, and adhere to UL standard 508 for dielectric voltage-withstand.
9. Each Circuit Monitor shall have built-in data communications to allow multipoint communication to multiple computer workstations, programmable controllers, and other host devices, at a minimum data rate of 9600 baud.
10. The data communications shall be optically isolated to provide reliable operation.
11. Power meter shall include a communications interconnection interface with the Building Management System (BMS). Coordinate interconnection requirements with the BMS provider. Available protocols:
    a. Modbus.
    b. Ion.
    c. DNP3.
    d. IEC 61850.
    e. HTTP.
    f. FTP.
    g. SNMP.
    h. DPWS.
    i. RSTP.
    j. NTP.
    k. SNTP.
    l. GPS.

S. Instrument Transformers:
1. Comply with IEEE C57.13.
2. Select suitable ratio, burden, and accuracy as required for connected devices.
3. Current Transformers: Connect secondaries to shorting terminal blocks.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Devices:
1. Fusible Switches:
    a. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
    b. Fuse Clips: As required to accept indicated fuses.
        1) Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

c. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

2. Fused Power-Circuit Devices:
   a. Description: Quick-make, quick-break, dead-front bolted-pressure contact switches and high-pressure butt contact switches listed and labeled as complying with UL 977; ratings, configurations, and features as indicated on the drawings.
   b. Bolted-Pressure Contact Switches: Devices with additional pressure or clamping action provided at both ends of switch blades when blades are in the fully closed position.
   c. High-Pressure Butt Contact Switches: Devices with butt-type contacts and spring-charged mechanism.
   d. Minimum Short Circuit Current Rating: 200,000 rms symmetrical amperes when protected by Class L fuses.
   e. Fuse Clips: As required to accept Class L fuses.
   f. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
   g. Provide the following features and accessories where indicated or where required to complete installation:
      1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
      2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating switch position.
      3) Blown fuse protection and indication.

B. Circuit Breakers:
   1. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated. Series rating not allowed.
   2. Main circuit breakers in all switchboards shall have Long time, Short time, Instantaneous and ground fault protection (LSIG) functions. These functions shall similar to those functions found on a Square D PowerPact circuit breaker. Circuit breaker shall have energy reduction maintenance setting (ERMS) system. Provide the following;
      a. Energy Reduction Maintenance Setting Switch (ERMS)
         1) For the Main circuit breaker above 1200 amps, provide a maintenance OFF ON selector switch on the compartment door to switch the circuit breaker instantaneous tripping characteristics to an alternate setting temporarily during maintenance activity.
         2) Provide a lock feature for the ERMS switch so that it may be locked in either the OFF or ON maintenance mode position.
         3) Provide a blue LED indicating light to indicate trip unit is in the ERMS mode.

3. Molded Case Circuit Breakers:
   a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
      1) Provide thermal magnetic circuit breakers unless otherwise indicated.
      2) Provide electronic trip circuit breakers where indicated.
   b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
      1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
      2) Provide interchangeable trip units for circuit breaker frame sizes 125A and above.
   c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
      1) Provide the following field-adjustable trip response settings:
         a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         b) Long time delay.
         c) Short time pickup and delay.
         d) Instantaneous pickup.
         e) Ground fault pickup and delay where ground fault protection is indicated.
      2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
      3) Provide communication capability where indicated: Compatible with system indicated.
   d. Provide the following circuit breaker types where indicated:
      1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
      2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
   e. Provide the following features and accessories where indicated or where required to complete installation:
      1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
      2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
      3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
      4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.

5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

4. Insulated Case Circuit Breakers:
   a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
   b. Operation:
      1) Provide manually operated circuit breakers unless otherwise indicated.
      2) Provide electrically operated circuit breakers where indicated.
      3) Pad-Lock Provision: For preventing circuit breaker closing operation.
   c. Construction:
      1) Provide fixed-mount circuit breakers unless otherwise indicated.
      2) Provide drawout circuit breakers where indicated.
   d. Drawout Circuit Breakers:
      1) Allows withdrawal of circuit breaker into test and disconnected positions, with racking position indication (connected, test, disconnected, withdrawn).
      2) Provide safety interlock to prevent racking of circuit breaker while in the ON position.
      3) Pad-Lock Provision: For preventing circuit breaker drawout operation.
   e. Trip Units: Solid state, microprocessor-based, true rms sensing.
      1) Provide the following field-adjustable trip response settings:
         a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         b) Long time delay.
         c) Short time pickup and delay.
         d) Instantaneous pickup.
         e) Ground fault pickup and delay where ground fault protection is indicated.
      2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
      3) Provide communication capability where indicated: Compatible with system indicated.
   f. Provide the following circuit breaker types where indicated:
      1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
      2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
   g. Provide the following features and accessories where indicated or where required to complete installation:

1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
3) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
4) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.
5) Truck-Operated Cell Switch: For indicating circuit breaker racking position.

2.4 SOURCE QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Factory test switchboards according to NEMA PB 2, including the following production tests on each switchboard assembly or component:
1. Dielectric tests.
2. Mechanical operation tests.
3. Grounding of instrument transformer cases test.
4. Electrical operation and control wiring tests, including polarity and sequence tests.
5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

E.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Arrange equipment to provide required clearances and maintenance access.

D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 6 inches between switchboard and wall.

E. Provide required support and attachment components in accordance with Section 260529.

F. Install switchboards plumb and level.

G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Division 03 - Concrete.

H. Provide grounding and bonding in accordance with Section 260526.

I. Install all field-installed devices, components, and accessories.

J. Provide fuses complying with Section 262813 for fusible switches as indicated.

K. Install identification in accordance with Section 260553.
   1. Labeling & Identification:
      a. Indicate the maximum available fault current at the equipment, including the date the fault current calculation was performed. Label shall include warning for “Arc Flash Hazard” and requirement for “PPE Protection”.
      b. Indicate locations of sources and feeders for all services to the building (generator and fire pump).

L. Installation of ERMS maintenance lockable selector switch and blue indicating light onto compartment door of the main circuit breaker. Installation of the IO module and the IFE module in accordance with manufactures recommendations.
   1. Set point for the ERMS instantaneous is based on manufactures recommendations. For Square D Power Pact circuit breaker (Basis of design) the default programmed setting to the instantaneous (li) set point is 2xIn.

M. Install breaker circuit directory.

N. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

O. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 260573.

P. Provide filler plates to cover unused spaces in switchboards.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

E. Inspect and test in accordance with NETA ATS, except Section 4.

F. Perform inspections and tests listed in NETA ATS, Section 7.1.

G. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

H. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 225 amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.
   2. Test functions of the trip unit by means of secondary injection.

I. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

J. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

K. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10.

L. Test shunt trips to verify proper operation.

M. Correct deficiencies and replace damaged or defective switchboards or associated components.

N. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

3.5 CLEANING

A. See Division 01 – General Requirements.

B. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

C. Repair scratched or marred surfaces to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. See Division 01 – General Requirements.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.7 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements.

B. Division 03 - Cast-in-Place Concrete: Concrete equipment pads.

C. Section 260526 - Grounding and Bonding for Electrical Systems.

D. Section 260529 - Hangers and Supports for Electrical Systems.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 260573 - Overcurrent Protective Device Coordination Study: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 262200 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.

H. Section 262813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service..

B. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NEMA FU 1 – Low Voltage Cartridge Fuses.

E. NECA 407 - Standard for Installing and Maintaining Panelboards.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

G. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

H. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).

I. NEMA PB 1 - Panelboards.

J. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

K. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

N. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

O. UL 67 - Panelboards; Current Edition, Including All Revisions.

P. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

Q. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

R. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

S. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

T. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

U. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation of listed series ratings upon request.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.
   3. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
   2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Schneider Electric; Square D Products.

B. ABB/GE.

C. Eaton Corporation.

D. Siemens Industry, Inc.

E. Substitutions: See Division 01 - Product Requirements.

F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
      b. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
   3. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
   4. Label equipment utilizing series ratings as required by NFPA 70.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
   3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
   2. Outdoor Locations: Type 4X.
   3. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
      c. Provide removable end walls for NEMA Type 1 enclosures.
      d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
   4. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
      c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.

5. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided, list and label panelboards as a complete assembly including surge protective device.

L. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
1. Ampere Rating: Not less than ampere rating of panelboard bus.
2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
3. Coil Voltage: As required for connection to control system indicated.

M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
   a. Use zero sequence ground fault detection method unless otherwise indicated.
   b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
   c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

N. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

O. Selective Coordination:
1. Fusible branch circuit panelboards overcurrent protective devices shall be selectively coordinated with all supply side (fed from both the normal and emergency source) overcurrent protective devices. Provide recommended fuses from a single manufacturer to maintain published minimum ampere coordination ratios.

P. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

Q. **Load centers are not acceptable**.

R. Provide the following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
2. Sub-feed lugs.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Tin plated copper.
   2. Ground Bus Material: Copper.

D. Circuit Breakers:
   1. Provide bolt-on type.
   2. Provide thermal magnetic circuit breakers unless otherwise indicated.
   3. Provide electronic trip circuit breakers where indicated, or as required for coordination.

E. Circuit breakers rated 1000 amps or more on solidly grounded 480V systems shall include ground fault protection.

F. Circuit breakers rated 1200 amps and above shall have Long time, Short time, Instantaneous and Ground fault protection (LSI) functions. These functions shall similar to those functions found on a Square D PowerPact circuit breaker. Circuit breaker shall have energy reduction maintenance setting (ERMS) system. Provide the following;
   1. Energy Reduction Maintenance Setting Switch (ERMS)
      a. For the circuit breakers above 1200 amps, provide a maintenance OFF ON selector switch on the compartment door to switch the circuit breaker instantaneous tripping characteristics to an alternate setting temporarily during maintenance activity.
      b. Provide a lock feature for the ERMS switch so that it may be locked in either the OFF or ON maintenance mode position.
      c. Provide a blue LED indicating light to indicate trip unit is in the ERMS mode.

G. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.
   2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.
   3. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   4. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   5. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Aluminum.
   3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   4. Provide clear plastic circuit directory holder mounted on inside of door.

F. Provide column-width panelboards with accessory column-width cable trough and pullbox where indicated.

2.5 FUSIBLE BRANCH CIRCUIT PANELBOARDS

A. Manufacturers:
   1. Fusible Panelboards shall be Cooper Bussmann™ Quik-Spec™ Coordination Panelboards type QSCP.
   2. Substitutions will be accepted only if the below requirements are met and written approval is provided from the engineer:
      a. The electrical contractor supplies a written request to the engineer three weeks prior to the project bid date
      b. The electrical contractor provides product documentation to prove complete compliance with specification and all pertinent codes and standards requirements as specified in this section.

B. Panelboard overcurrent protective device interrupting ratings shall be fully rated for the maximum available fault current and have a UL Listed interrupting rating of 300kA and CSA Certified interrupting rating of 200kA with SPD. SPD protection for 480V, 3-phase shall have L-N=600, L-G=600, N-G=600, L-L =1000 and for 480Y L-N=1200, L-G=1200, N-G=1200, L-L=2000.

C. Construction:
   1. Panelboard circuits 100A and less shall incorporate overcurrent protection and branch-circuit rated disconnecting means into a single integrated component.
   2. Interiors shall be factory assembled.
   3. Panelboard shall be equipped with a six-space spare fuse compartment for storing replacement branch circuit fuses. Spare fuse compartment shall be located behind locking panel door.
   4. Bus bars shall be tin-plated copper with sufficient cross sectional area to meet UL 67 temperature rise requirements.
   5. 200A/400A rated neutrals shall be standard.

6. Main lug conductor terminations:
   a. MLO terminations shall be rated for 60/75°C, Cu-Al
   b. Main disconnect terminations shall be rated for 75°C, Cu Only
7. NEMA 1 panelboards shall be field convertible for top or bottom incoming feed.

D. Main Disconnect:
1. Permanently installed lockout means shall be provided on the main disconnect for lockout tagout procedures.
2. Main disconnect shall be quick-make, quick-break type.

E. Branch Fused Disconnects:
1. Device shall have visible circuit ON/OFF indication with colored and international symbol markings.
2. Device shall provide open fuse indication via permanently installed neon indicating light.
3. Device shall be UL and cUL Listed 600Vac/200kA or 125Vdc/100kA voltage/short-circuit current rating, load-break disconnect with amp ratings and number of poles as indicated on the panelboard schedule.
4. Fuse and disconnect assembly shall be a finger-safe component with trim installed.
5. Fuse and disconnect shall be mechanically interlocked so as not to allow fuse removal while fuse terminals are energized.
6. No special tools shall be required for fuse removal.
7. Devices shall have bolt-on style bus connectors.
8. Device housing shall be clearly marked with device amperage.
9. Permanently installed lockout means shall be provided on the device for lockout tagout procedures. Permanently installed means for locking device in the ON position shall also be provided.
10. Device shall provide fuse amp rating rejection at the following ampacities to ensure continued circuit protection at the specified circuit rating: 15A, 20A, 30A, 40A, 50A, 60A, 70A, 90A & 100A.

F. Main and Branch Circuit Overcurrent Protection
1. All overcurrent protective devices shall have a minimum UL Listed interrupting rating of 300kA and CSA Certified interrupting rating of 200kA.
2. Branch circuit overcurrent protection shall be 600Vac UL Listed minimum 300kA IR and CSA Certified minimum 200kA IR finger-safe fuse with Class J* performance characteristics.
3. Main overcurrent protective devices shall be 600Vac UL Listed minimum 300kA IR and CSA Certified minimum 200kA IR Class J time-delay fuses or Class J performance fuses.
4. Where panelboard main fuses are installed, fuses in panelboard branch circuits shall selectively coordinate with main fuses for all overcurrent ratings up to 200kA.

G. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.

H. Minimum Integrated Short Circuit Rating: Calculated based on primary transformer available SCR and as indicated on plans.

I. Enclosure:
1. NEMA 1 enclosures shall be surface or flush mount as indicated in associated schedules or drawings.

2. Boxes shall be a nominal 20 inches wide and 5-¾ inches deep with wire bending space per the National Electrical Code.
3. Panelboard trim shall be supplied with lockable door covering all disconnect handles.
4. Panelboard trim shall be dead-front construction covering all energized parts.
5. Door-in-door type trim shall be provided for NEMA 1 enclosures where it is specified in the associated schedules or drawings.
6. Front trim shall be lockable. All lock assemblies shall be keyed alike with like NEMA rated enclosures.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
   a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
4. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Provide compression lugs where indicated.
   c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

B. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 14,000 rms symmetrical amperes at 480 VAC.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
3. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Provide compression lugs where indicated.
   c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

b. Provide interchangeable trip units where indicated.

5. Electronic Trip Circuit Breakers: Where indicated on drawings, furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following field-adjustable trip response settings:
      1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      2) Long time delay.
      3) Short time pickup and delay.
      4) Instantaneous pickup.
      5) Ground fault pickup and delay where ground fault protection is indicated.
   b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
   c. Provide communication capability where indicated: Compatible with system indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
   d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
8. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
9. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
10. Do not use tandem circuit breakers.
11. Do not use handle ties in lieu of multi-pole circuit breakers.
12. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
13. Provide the following features and accessories where indicated or where required to complete installation:
   a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
   c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
   d. Under-voltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
   e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.7 SOURCE QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required supports in accordance with Section 260529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Division 03.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 260526.
   1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
   2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

L. Install all field-installed branch devices, components, and accessories.

M. Provide fuses complying with Section 262813 for fusible switches as indicated.

N. Energy Reduction Maintenance Switch:
   1. Installation of ERMS maintenance lockable selector switch and blue indicating light onto compartment door of the circuit breaker. Installation of the IO module and the IFE module in accordance with manufactures recommendations.
      a. Set point for the ERMS instantaneous is based on manufactures recommendations. For Square D Power Pact circuit breaker (Basis of design) the default programmed setting to the instantaneous (li) set point is 2xIn.

O. Install a permanent label indicating the panelboard or transformer where the power supply to the panel originates.

P. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

Q. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

R. Set field-adjustable circuit breaker tripping function settings as indicated.

S. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 260573.

T. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

U. Provide filler plates to cover unused spaces in panelboards.

V. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

W. Identify panelboards in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 800 amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.

2. Test functions of the trip unit by means of secondary injection.

E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

F. Test GFCI circuit breakers to verify proper operation.

G. Test AFCI circuit breakers to verify proper operation.

H. Test shunt trips to verify proper operation.

I. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

J. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. See Division 01 – General Requirements.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

C. Adjust alignment of panelboard fronts.

D. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. See Division 01 – General Requirements.

B. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

C. Repair scratched or marred exterior surfaces to match original factory finish.

3.6 PROTECTION

A. Protect installed panelboards from subsequent construction operations.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Division 09 - Finishes

C. Section 260400 – General Conditions for Electrical Trades

D. Section 260519 - Electrical Power Conductors and Cables.

E. Section 260526 - Grounding and Bonding for Electrical Systems.

F. Section 260503 – Equipment Wiring Connections.

G. Section 260533 – Raceways and Boxes for Electrical Systems.

H. Section 260553 - Identification for Electrical Systems.

I. Section 260923 - Lighting Control Devices.

J. Section 262913 - Enclosed Controllers.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Revision H.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Revision G.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

E. NEMA WD 1 - General Color Requirements for Wiring Devices.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

H. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

I. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

J. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

K. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

L. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

M. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

N. UL 1917 - Solid-State Fan Speed Controls; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01 - General Requirements.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   1. Wall Dimmers: Include derating information for ganged multiple devices.
   2. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.

C. Samples: One for each type and color of device and wall plate specified.

D. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data:
   1. Wall Dimmers: Include information on operation and setting of presets.
   2. GFCI Receptacles: Include information on status indicators.
   3. Surge Protection Receptacles: Include information on status indicators.

G. Project Record Documents: Record actual installed locations of wiring devices.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - General Requirements, for additional provisions.
   2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
   3. Extra Keys for Locking Switches: Two of each type.
   4. Extra Surge Protection Receptacles: Two of each type.
   5. Extra Wall Plates: One of each style, size, and finish.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles where indicated on the drawings.

E. Provide GFCI protection for receptacles installed within 6 feet of water source.

F. Provide GFCI protection for receptacles installed in dwelling unit kitchens.

G. Provide GFCI protection in other than dwelling units for all single-phase receptacles rated 150 volts to ground or less and all three-phase receptacles rated 150 volts to ground or less, 100 amperes of less in: Bathrooms, Kitchens and on Rooftops

H. Provide GFCI protection for receptacles serving electric drinking fountains.

I. Unless noted otherwise, do not use combination switch/receptacle devices.

2.2 WALL SWITCHES: See Section 260923 – Lighting Control Devices for specifications.

2.3 WALL DIMMERS: See Section 260923 – Lighting Control Devices for specifications.

2.4 FAN SPEED CONTROLLERS

A. Manufacturers:
1. Leviton Manufacturing Company, Inc.
2. Lutron Electronics Company, Inc; Maestro Series
3. Pass & Seymour, a brand of Legrand North America, Inc.
4. Substitutions: See Division 01 - General Requirements

B. Description: 120 V AC, solid-state, full-range variable speed, slide control type with separate on/off switch, with integral radio frequency interference filtering, fan noise elimination circuitry, power failure preset memory, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1917.
1. Current Rating: 1.5 A unless otherwise indicated or required to control the load indicated on the drawings.

2.5 RECEPTACLES

A. Manufacturers:
1. Hubbell Incorporated
2. Leviton Manufacturing Company, Inc.
3. Pass & Seymour, a brand of Legrand North America, Inc.
4. Substitutions: See Division 01 - General Requirements.
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.
3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.
4. Body color:

a. General Purpose Receptacles: color by Architect.
b. Emergency, [Critical Branch], [Equipment Branch] receptacles: Red.

C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
3. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
4. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
5. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
6. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
7. Illuminated Convenience Receptacles: Hospital grade, 20A, 125V, NEMA 5-20R; illuminated face or indicator light to indicate power is being supplied to receptacle; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

E. USB Charging Devices:
1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.

2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
3. USB Charging Noncombination Devices: Four-port; rectangular decorator style.

F. Surge Protection Receptacles:
1. Surge Protection Receptacles - General Requirements: Listed and labeled as complying with UL 1449, Type 2 or 3.
a. Energy Dissipation: Not less than 240 J per mode.
b. Protected Modes: L-N, L-G, N-G.
c. UL 1449 Voltage Protection Rating (VPR): Not more than 700 V for L-N, L-G modes and 1200 V for N-G mode.
d. Diagnostics:
1) Visual Notification: Provide indicator light to report functional status of surge protection.
2) Audible Notification: Provide switchable audible alarm to report that surge protection is not functional.
2. Standard Surge Protection Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

G. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.
1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.
2. Special Purpose Locking Receptacles: refer to drawings and schedules for NEMA locking configuration.

H. Special Purpose Receptacles: Industrial specification grade, straight blade grounding devices.
1. Refer to drawings and schedules for NEMA configuration.

I. Clock Hanger Receptacles: Single, 15A, 125V, NEMA 5-15R.

2.6 WALL PLATES

A. Manufacturers:
1. Hubbell Incorporated
2. Leviton Manufacturing Company, Inc.
3. Pass & Seymour, a brand of Legrand North America, Inc.
4. Substitutions: See Division 01 - General Requirements.
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Screws: Metal with slotted heads finished to match wall plate finish.
3. Provide screwless wallplates with concealed mounting hardware where indicated.

C. As selected by Architect

OR

D. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

E. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

F. Brass Wall Plates: Brushed satin finish, factory-coated to inhibit oxidation.

G. Aluminum Wall Plates: Smooth satin finish, clear anodized, factory-coated to inhibit oxidation.

H. Chrome Wall Plates: Smooth finish, chrome plated steel.

I. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

J. Premarked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.

K. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

L. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Wall Dimmers: 48 inches above finished floor.
      c. Fan Speed Controllers: 48 inches above finished floor.
      d. Receptacles: 18 inches above finished floor or 6 inches above counter.
      e. Install convenience GFCI type receptacles 36 to 48 inches above roof deck.
      f. Or at designated heights as indicated on drawings.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in special application enclosures per manufacturer’s instructions, provide stainless steel cover plates.

D. Install wiring devices in accordance with manufacturer's instructions.

E. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

F. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

G. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper. When stranded conductors are used in lieu of solid, use insulated crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screw terminals.

I. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

J. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

K. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

L. Install wiring devices plumb and level with mounting yoke held rigidly in place.

M. Install wall switches with OFF position down.

N. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

O. Do not share neutral conductor on branch circuits utilizing wall dimmers.

P. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

Q. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

R. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

S. Identify wiring devices in accordance with Section 260553.

3.4 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI protected receptacle for proper tripping operation according to manufacturer's instructions.

F. Inspect each surge protection receptacle to verify surge protection is active.

G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 262813 - FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2 RELATED REQUIREMENTS

A. See Division 01 – General Requirements

B. Section 260400 – General Conditions for Electrical Trades

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260573 – Overcurrent Protective Device Coordination Study: Additional criteria for the selection of protective devices specified in this section.

E. Section 262413 - Switchboards: Fusible switches.

F. Section 262416 - Panelboards: Fusible switches.

G. Section 262819 - Enclosed Switches: Fusible switches.

H. Section 262913 - Enclosed Controllers: Fusible switches.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. See Division 01: General Requirements

B. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Switches for Switchboards: See Section 262413.
      b. Fusible Switches for Panelboards: See Section 262416.
      c. Fusible Enclosed Switches: See Section 262819.
      d. Fusible Switches for Enclosed Motor Controllers: See Section 262913.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain written direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
   1. Spare Fuse Cabinet: Include dimensions.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - Product Requirements, for additional provisions.
   2. Extra Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.
   4. Spare Fuse Cabinet Keys: Two.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussmann

B. Littelfuse, Inc.

C. Ferraz Shawmut

D. Substitutions: See Division 01- General Requirements.

2.2 APPLICATIONS

A. Service Entrance:
1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
2. Fusible Switches Larger than 600 Amperes: Class L, time-delay.

B. Feeders:
1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
2. Fusible Switches Larger than 600 Amperes: Class L, time-delay.

C. General Purpose Branch Circuits: Class RK1, time-delay.

D. Individual Motor Branch Circuits: Class RK1, time-delay.

E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

F. Primary Protection for Control Transformers: Class CC, time-delay.

2.3 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class J Fuses: Comply with UL 248-8.

I. Class L Fuses: Comply with UL 248-10.

J. Class T Fuses: Comply with UL 248-15.

K. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

L. Provide the following accessories where indicated or where required to complete installation:
   1. Fuseholders: Compatible with indicated fuses.
   2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

2.4 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

D. Identify spare fuse cabinet in accordance with Section 260553.

END OF SECTION

SECTION 262819 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fusible and non-fusible switches.

B. Related Sections:
   1. Section 262813 - Fuses.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

   1. NEMA FU 1 - Low Voltage Cartridge Fuses.

   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:

   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.

PART 2 PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:

   1. General Electric.

   2. Square D.

3. Siemens.

4. Eaton/Cutler Hammer.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray or stainless steel for 4X applications.

1. Interior Dry Locations: Type 1.

2. Exterior Locations: Type 4X.

3. Pool Chemical Exposure Locations: Type 4X.

E. Furnish switches with entirely copper current carrying parts.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:

1. General Electric.

2. Square D.

3. Siemens.

4. Eaton/Cutler Hammer.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Same as fused switches, except non fused type.

C. Enclosure: Same as fused switches, except non fused type.

D. Furnish switches with entirely copper current carrying parts.

2.3 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

B. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere); 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection schemes). 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosed switches plumb. Provide supports in accordance with Section 260529.

B. Height:5 feet to operating handle.

C. Install fuses for fusible disconnect switches. Refer to Section 262813 for product requirements.

D. Install engraved plastic nameplates in accordance with Section 260553.

E. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION

SECTION 262826 - ENCLOSED TRANSFER SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
   1. Automatic transfer switches.
   2. Manual transfer switches.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Division 03 - Cast-in-Place Concrete: Concrete equipment pads.

C. Division 14 – Elevators: For interface with transfer switch.

D. Section 260400 – General Conditions for Electrical Trades.

E. Section 260526 - Grounding and Bonding for Electrical Systems.

F. Section 260529 - Hangers and Supports for Electrical Systems.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 260573 – Overcurrent Protective Device Coordination Study: Additional criteria for the selection of equipment specified in this section.

I. Section 262819 - Enclosed Switches: Safety switches not listed for use as transfer switch equipment.

J. Section 263213 - Engine Generators: For interface with transfer switches.
   1. Includes code requirements applicable to work of this section.
   2. Includes additional testing requirements.
   3. Includes related demonstration and training requirements.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 99 - Health Care Facilities Code.

G. NFPA 110 - Standard for Emergency and Standby Power Systems.

H. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

I. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
   a. Engine Generators: See Section 263213.
   b. Elevators.
   c. [Battery System, other]
2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate the work with placement of supports, anchors, etc. required for mounting.

5. Closed Transition Transfer Switches:
   a. Coordinate source interconnection requirements with Utility Company.
   b. Where applicable, coordinate the work to provide engine generators with isochronous governors suitable for closed transition transfer.
   c. Coordinate the work to provide shunt trip breakers necessary for protection from source interconnection for longer than specified maximum interconnection time.
   d. Pre-installation Meeting: Convene one week prior to commencing work of this section to review interconnection requirements and details with Utility Company representative.
   e. Arrange for inspections necessary to obtain Utility Company approval of installation.
6. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Pre-installation Meeting: Convene one week before starting work of this section; require attendance of all affected installers.

C. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.5 SUBMITTALS

A. See Division 01 - General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
   1. Where applicable, include characteristic trip curves for overcurrent protective devices upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

D. Warranty: Submit sample of manufacturer's warranty.

E. Evidence of qualifications for installer.

F. Evidence of qualifications for maintenance contractor (if different entity from installer).

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

H. Manufacturer's certification that products meet or exceed specified requirements.

I. Source quality control test reports.

J. Manufacturer’s detailed field-testing procedures.

K. Field quality control test reports.

L. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

M. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

N. Maintenance contracts.

O. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

P. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - General Requirements.
   2. Bypass/Isolation Transfer Switches: Provide accessories (ramps, dollies, etc.) necessary for removal of draw-out components.

1.6 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).

2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for system Level specified in Section 263213.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
1. Authorized service facilities located within 100 [XXX] miles of project site.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with power transfer systems of similar size, type, and complexity; manufacturer's authorized installer.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
1. Contract maintenance office located within 100 [XXX] miles of project site.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturers required service conditions during and after installation.

1.9 WARRANTY

A. See Division 01 – General Requirements.

B. Provide minimum one-year manufacturer warranty covering repair or replacement due to defective materials or workmanship commencing from the Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Transfer Switches - Basis of Design: ASCO Power Technologies as described below.

B. Transfer Switches - Other Acceptable Manufacturers:
   1. ABB.
   2. ESL Power Systems (Manual Transfer Switches only)
   3. Russelectric.
   4. Same as manufacturer of engine generator(s) used for this project.

C. Substitutions: See Division 01 - General Requirements.

D. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

E. Source Limitations: Furnish transfer switches and accessories produced by a single manufacturer and obtained from a single supplier.

2.2 TRANSFER SWITCHES

A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Applications:
   1. Utilize open transition transfer unless otherwise indicated or required.
   2. For transfer of highly inductive loads (e.g. large motors and transformers), utilize open transition transfer with in-phase monitor or delayed transition transfer.
   3. Neutral Switching (Single Phase, Three Wire and Three Phase, Four Wire Systems):
      a. Unless otherwise indicated or required, provide solid (unswitched) neutral.
      b. Unless otherwise indicated or required, provide neutral switching:
         1) For systems with ground fault protection.
         2) Where the alternate/emergency source is a separately derived system.
   4. Provide signal before transfer contacts for transfer switches serving elevators.

D. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.

E. Automatic Transfer Switch:
   1. Transfer Switch Type NEMA ICS 10, automatic transfer switch [automatic and bypass/isolation switch] [suitable as service equipment].
   2. Transition Configuration: [Open Transition], [Closed Transition], [Delayed Transition]. Electrically operated, mechanically held.
   3. Voltage: As indicated on the drawings.
   4. Ampere Rating: As indicated on the drawings.
   5. Neutral Configuration: [Solid neutral (unswitched)], [switched neutral]
   6. Load Served: As indicated on the drawings.
   7. Primary Source: As indicated on the drawings.
   8. Alternate Source: As indicated on the drawings.

F. Non-Automatic Transfer Switch:
   1. Transfer Switch Type: NEMA ICS 10, non-automatic transfer switch [suitable as service equipment].
   2. Transition Configuration: [Open Transition], [Closed Transition], [Delayed Transition]. Electrically operated, mechanically held.
   3. Voltage: As indicated on the drawings.
   4. Ampere Rating: As indicated on the drawings.
   5. Neutral Configuration: [Solid neutral (unswitched)], [switched neutral].
   6. Load Served: As indicated on the drawings.
   7. Primary Source: As indicated on the drawings.
   8. Alternate Source: As indicated on the drawings.

G. Manual Transfer Switch:
   1. UL 1008, manual transfer switch [suitable as service equipment].
   2. Voltage: As indicated on the drawings.
   3. Ampere Rating: As indicated on the drawings.
   4. Neutral Configuration: [Solid neutral (unswitched)], [switched neutral] except as indicated.
   5. Load Served: As indicated on the drawings.
   6. Primary Source: As indicated on the drawings.
   7. Alternate Source: As indicated on the drawings.

H. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).

I. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.

J. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.

K. Switching Methods:
   1. Open Transition:
      a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
      b. Where in-phase transfer is indicated, utilize in-phase monitor to initiate transfer when phase angle difference between sources is near zero to limit in-rush currents.
   2. Delayed Transition:
      a. Provide break-before-make transfer with programmable time delay in a neutral position not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
   3. Closed Transition:
      a. When both sources are available and synchronized, provide make-before-break transfer without interruption of power to the load and with momentary interconnection of both sources for not more than 100 ms, unless otherwise approved by Utility Company.
      b. Provide synchronization/in-phase monitor to initiate transfer when voltage and phase angle difference between sources are within predetermined requirements for synchronization.

c. Source Synchronization Requirements: Phase angle differential within five degrees; voltage differential within five volts.
d. When sources fail to synchronize within a predetermined time period, remain connected to current source and initiate an alarm.
e. When sources remain interconnected for longer than specified maximum interconnection time, provide contact closure signal to shunt trip designated circuit breaker and initiate an alarm.
f. Provide additional protective relaying where required by Utility Company.
g. When only one source is available, automatically utilizes open transition (break-before-make) transfer.

4. Neutral Switching: Either simultaneously switched neutral (break-before-make) or overlapping neutral (make-before-break) methods are acceptable.
5. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

L. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.

M. Enclosures:
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1 or Type 12.
b. Outdoor Locations: Type 4X.
2. Provide lockable door(s) for outdoor locations.
3. Finish: Manufacturer's standard unless otherwise indicated.

Short Circuit Current Rating:

4. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
5. Short Time Rating: Where the requirement for selectivity is indicated, provide transfer switches with short time ratings suitable for the maximum short time delay setting of the supply side overcurrent protective device.

N. Automatic Transfer Switches:
1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.
2. Control Functions:
a. Automatic mode.
b. Test Mode: Simulates failure of primary/normal source.
1) Mount control in cover of enclosure to simulate failure of normal source.
c. Voltage and Frequency Sensing:
1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.
2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.

3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.

d. Outputs:
   1) Contacts for engine start/shutdown.
   2) Auxiliary contacts; one set of normally open/normally closed contacts) for each switch position.
   3) Signal before transfer (load disconnect) contacts; for selective load disconnection prior to transfer.

e. Adjustable Time Delays:
   1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.
   2) Transfer to alternate/emergency source time delay.
   3) Retransfer to primary/normal source time delay.
   4) Signal before transfer (load disconnect) contact time delay.
   5) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.

f. In-Phase Monitor (Open Transition Transfer Switches): Monitors phase angle difference between sources for initiating in-phase transfer.

g. Synchronization/In-Phase Monitor (Closed Transition Transfer Switches): Monitors voltage and phase angle difference between sources for initiating synchronized transfer.

h. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.
   1) Start engine every 7 days; run for 10 minutes before shutting down.
   2) Bypass exerciser control when normal source fails during exercise period.

i. Retransfer to Normal Switch: Bypasses time delays for retransfer to primary/normal source.
   1) Mount in cover of enclosure to initiate manual transfer from alternate source to normal source.

j. _____.

3. Status Indications – Enclosure cover mounted:
   a. Connected to alternate/emergency source.
   b. Connected to primary/normal source.
   c. Alternate/emergency source available.
   d. Primary/normal source available.

4. Alarm Indications for Closed Transition Transfer Switches:
   a. Failure to synchronize.
   b. Extended source interconnection/transfer switch locked out.

5. Automatic Sequence of Operations:
   a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator.
   b. Where applicable, initiate signal before transfer (load disconnect) contacts at programmable time before transfer.
   c. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.
   d. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.

e. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.

f. Required emergency systems transfer switch and generator shall be configured in accordance with NFPA 70 to ensure emergency power is available within 10 seconds of failure of the normal supply. The Contractor shall coordinate starting and stabilization time with the generator supplier and set all time delays to ensure the required 10 second maximum time period is met.

O. Manual Transfer Switches:

1. Manual transfer switch shall consist of (2) two mechanically-interlocked molded case circuit breakers, cam-style male connectors, power distribution block and grounding terminals, all housed within a padlockable enclosure.
2. Manual transfer switch enclosure shall be Type 3R, constructed of continuous seam-welded, powder coated galvanneal steel. The main access shall be through an interlocked, hinged door that extends the full height of the enclosure. Access for portable generator cables with female cam-style plugs shall be via
   a. Drawn flange cable entry openings in the bottom of enclosure for wall mount units, or
   b. Hinged lower door for pad mount units. A hinged flap door shall be provided to cover the cable openings when cables are not connected; the hinged flap door shall allow cable entry only after the main access door has been opened.
   c. Enclosure shall be powder coated after fabrication; color shall be wrinkle gray RAL 7035.
3. Cam-style male connectors (inlets) shall be UL Listed single-pole separable type and rated 200 amps at 600VAC. Cam-style male connectors shall be color coded. Cam-style male connectors shall be provided for each phase and for ground, and shall also be provided for neutral if required. Each of the phase cam-style male connectors within the enclosure shall be factory-wired to a molded case circuit breaker. The ground cam-style male connectors shall be bonded to the enclosure, and a ground lug shall be provided for connection of the facility ground conductor. The neutral cam-style male connectors, if required, shall be factory wired to a power distribution block. None of the cam-style male connectors shall be accessible unless both molded case circuit breakers are in the “OFF” position and the main access door is open.
4. A power distribution block shall be provided for load-side field wiring. The power distribution block shall be factory wired to the molded case circuit breakers.
5. Molded case circuit breakers shall be UL Listed and the short circuit interrupt rating shall be a minimum of 35kAIC at 480VAC. Trip rating of the molded case circuit breakers shall be as shown on the drawings. One molded case circuit breaker shall be fed from utility power; the other molded case circuit breaker shall be fed from the cam-style male connectors to supply power from a portable generator. Both molded case circuit breakers shall include UL Listed door-mounted operating mechanisms, preventing the opening of the main access door unless both breakers are in the “OFF” position. Both molded case circuit breakers shall be mounted behind a deadfront panel. The load-side of the molded case circuit breakers shall not be energizable unless the main access door is closed and one of the molded case circuit breakers is in the “ON” position. The (2) molded case circuit breakers shall be safety interlocked by mechanical means to ensure that only one breaker can be closed at any given time.

P. Interface with Other Work:
   1. Interface with engine generators as specified in Section 263213.
   2. Interface with elevators as specified in Division 14.
      a. Utilize signal before transfer contacts to disconnect elevator(s) served prior to transfer.
   3. Interface with Existing Work: _____.

2.3 ENGINE START MONITORING SYSTEM

A. Provide an engine start monitoring system to monitor the engine start circuits from the transfer switches; start the generator; and signal an alarm condition to the building fire alarm system and generator remote annunciator.

B. Basis of design: ASCO 5101 engine start circuit monitor.

C. The system shall include the following:
   1. ATS Engine start modules (one for each transfer switch). Din rail mounted, coordinate mounting in transfer switches with transfer switch manufacturers.
   2. Generator start module, locate at generator.
   3. 24 VDC power supply for generator start module (battery backed up or from generator batteries).
   4. UL listed DPDT relay at generator start module for separate dry contact signaling of generator remote annunciator and fire alarm system.

D. Specifications:
   1. DDC Power: Generator Module - 9-27V; ATS module (power from circuit).
   2. Internal ride through: 3 seconds maximum.
   3. Operating Temperature: -4 to 158º F.
   4. Maximum wiring distance: 1,000 ft. one way.
   5. Maximum wire loop resistance: <100 ohms.
   6. Generator start contacts: 1A @ 30 VDC (Form C).
   7. Generator alarm contacts: 1A @ 30 VDC (Form C).

2.4 SOURCE QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Perform production tests on transfer switches at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned transfer switches.

B. Clean and repair existing transfer switches to remain or to be reinstalled.

C. Refer to paragraphs 3.3 & 3.4 for installation and testing requirements.

3.2 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive transfer switches.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment in accordance with Section 260529.

E. Install transfer switches plumb and level.

F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Division 03.

G. Provide grounding and bonding in accordance with Section 260526.

H. Install engraved plastic nameplates in accordance with Section 260553 and the following:

1. For Emergency Sources (emergency lighting): A sign shall be placed at the service-entrance equipment, at the meter location, and on any equipment up to the service entrance-equipment indicating type and location of on-site emergency power sources.

2. For Standby Sources: A sign shall be placed at the service-entrance equipment, at the meter location, and on any equipment up to the service-entrance equipment, that indicates the type and location of on-site optional standby power sources.

3.4 FIELD QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Prepare and start system in accordance with manufacturer's instructions.

D. Automatic Transfer Switches:

1. Inspect and test in accordance with NETA ATS, except Section 4.
2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The control wiring insulation-resistance tests listed as optional are not required.
    a. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

E. Provide additional inspection and testing as required for completion of associated engine generator testing as specified in Section 263213.

F. Test the following for the Engine Start Monitoring System:
1. Generator module receiving 24 VDC power.
2. Signals from all ATS modules to the Generator module.
3. Alarm signals to external devices.
4. Engine start signal to generator.
5. DIP switch settings.
6. LED status signals.

G. Adjust control and sensing devices to achieve specified sequence of operation.

H. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

I. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.5 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. See Division 01 – General Requirements.

B. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of transfer switches.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

D. Coordinate with related generator demonstration and training as specified in Section 263213.

3.7 PROTECTION

A. Protect installed transfer switches from subsequent construction operations.

3.8 MAINTENANCE

A. See Division 01 – General Requirements.

B. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of transfer switches for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.

D. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 4 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

END OF SECTION

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed NEMA motor controllers for low-voltage (600 V and less) applications:
   1. Magnetic motor starters.
   2. Manual motor starters.
   3. Motor-starting switches without overload protection.

B. Overcurrent protective devices for motor controllers, including overload relays.

C. Motor control accessories:
   1. Auxiliary contacts.
   2. Pilot devices.
   3. Control and timing relays.
   4. Control power transformers.
   5. Control terminal blocks.

1.2 RELATED REQUIREMENTS

A. Section 260400 – General Conditions for Electrical Trades.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 260573 – Overcurrent Protective Device Coordination Study: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

F. Section 262813 - Fuses: Fuses for fusible switches.
   1. Includes requirements for spare fuses and spare fuse cabinets.

G. Section 262923 - Variable-Frequency Motor Controllers.

1.3 REFERENCE STANDARDS

A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.

E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2000 (R2010).

F. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (R2011).

G. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

L. UL 60947-1 - Low-Voltage Switchgear and Control Gear - Part 1: General Rules; Current Edition, Including All Revisions.

M. UL 60947-4-1 - Low-Voltage Switchgear and Control Gear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Division 01 – General Requirements.

B. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
3. Coordinate the work to provide motor controllers and associated wiring suitable for interface with control devices to be installed.
4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
6. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain written direction before proceeding with work.

1.5 SUBMITTALS

A. Division 01 - General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of enclosed motor controllers and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
4. Include documentation of listed series ratings upon request.
5. Include documentation demonstrating selective coordination upon request.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field Quality Control Test Reports.

F. Project Record Documents: Record actual installed locations of motor controllers and final equipment settings.
1. Include nameplate data of actual installed motors and associated overload relay selections and settings.
2. Motor Circuit Protectors: Include magnetic instantaneous trip settings.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Division 01 – General Requirements Electronic Trip Circuit Breakers: Provide one portable test set.
2. Indicating Lights: Two of each different type.
3. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Franklin Control Systems.

B. Eaton Corporation.

C. General Electric Company.

D. Rockwell Automation, Inc.; Allen-Bradley Products.

E. Schneider Electric; Square D Products.

F. Substitutions: Division 01 – General Requirements

G. Source Limitations: Furnish enclosed motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.
1. Motor-starting switches without overload protection may be produced by the same manufacturer as the wiring devices used for this project.

2.2 ENCLOSED MOTOR CONTROLLERS

A. Provide enclosed motor controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Enclosed motor controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:
1. Provide motor controllers and associated components suitable for operation under the following service conditions without derating:
a. Altitude:
1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet .
2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet .
b. Ambient Temperature: Between 32 degrees F and 104 degrees F .
2. Provide motor controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:
   1. Provide motor controllers with listed short circuit current rating not less than the available fault current at the installed location or as indicated on the drawings.
   2. Provide motor controllers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
   3. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
   4. Label equipment utilizing series ratings as required by NFPA 70.

F. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures:
   1. Comply with NEMA ICS 6.
   2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
      c. Hazardous (Classified) Locations: Type 7/9, as required for the classification of the installed location.
   3. Finish: Manufacturer's standard unless otherwise indicated.

I. Instrument Transformers:
   1. Comply with IEEE C57.13.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Connect secondary conductors to shorting terminal blocks.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

J. Magnetic Motor Starters: Combination type unless otherwise indicated.
   1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
   2. Non-combination Magnetic Motor Starters: NEMA ICS 2, Class A non-combination motor controllers with magnetic contactor(s) and overload relay(s).
   3. Configuration: Full-voltage non-reversing unless otherwise indicated.
   4. Minimum Starter Size: NEMA Size 00.
   5. Use of non-standard starter sizes smaller than specified standard NEMA sizes is not permitted.
   6. Disconnects:
      a. Disconnect Switches: Fusible type unless otherwise indicated. See Section 262819 for requirements of disconnect switches.
      b. Provide auxiliary interlock for disconnection of external control power sources where applicable.
   7. Overload Relays: Bimetallic thermal type [SOLID STATE] unless otherwise indicated.
   8. Pilot Devices Required:
      a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.

b. Single-Speed, Non-Reversing Starters:
   1) Selector Switches: HAND/OFF/AUTO.
   2) Indicating Lights: Red OFF, Green ON.
c. Single-Speed, Reversing Starters:
   1) Selector Switches: FOR/OFF/REV.
   2) Indicating Lights: Green FOR, Yellow REV, Red OFF.
d. Two-Speed Starters:
   1) Selector Switches: SLOW/OFF/FAST.
   2) Indicating Lights: Green FAST, Yellow SLOW, Red OFF.

K. Manual Motor Starters:
1. Description: NEMA ICS 2, Class A manually operated motor controllers with overload relay(s).
2. Configuration: Non-reversing unless otherwise indicated.
3. Fractional-Horsepower Manual Motor Starters:
   a. Furnish with toggle operator.
   b. Overload Relays: Bimetallic or melting alloy thermal type.
   c. Provide means for locking operator in the OFF position.
   d. Furnish Green ON indicating light where not within sight of equipment.
   e. Provide with auxiliary contacts; normally open (NO) or normally closed (NC) as indicated or as required.

L. Motor-Starting Switches: Horsepower-rated switches without overload protection; toggle operator.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:
1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
2. Trip-free operation.
3. Visible trip indication.
4. Resettable.
   a. Employ manual reset unless otherwise indicated.
   b. Employ automatic reset or remote reset where indicated.
   c. Do not employ automatic reset with two-wire control.
5. Bimetallic Thermal Overload Relays:
   a. Provide ambient temperature compensation.
   b. Interchangeable current elements/heaters.
   c. Adjustable trip; plus/minus 10 percent of nominal, minimum.
   d. Designed for quicker trip response under phase loss condition.
   e. Trip test function.
   f. Provide isolated alarm contact where indicated.
6. Melting Alloy Thermal Overload Relays:
   a. Interchangeable current elements/heaters.
   b. Provide isolated alarm contact where indicated.
7. Solid-State Overload Relays:
   a. Selectable inverse-time trip class rating; available ratings of Class 10, 20, and 30, minimum.
   b. Adjustable full load current.

c. Phase loss protection.
d. Phase imbalance protection.
e. Ground fault protection.
f. Ambient temperature insensitive.
g. Thermal memory.
h. Repeat Trip Accuracy: Plus/minus 2 percent, minimum.
i. Trip test function.
j. Provide isolated alarm contact.
k. Provide communication capability where indicated: Compatible with system indicated.

B. Fusible Disconnect Switches:
1. See Section 262819 for requirements of disconnect switches.

2.4 MOTOR CONTROL ACCESSORIES

A. Auxiliary Contacts:
1. Comply with NEMA ICS 5.
2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.

B. Pilot Devices:
1. Comply with NEMA ICS 5; heavy-duty type.
2. Nominal Size: 30 mm.
3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
5. Indicating Lights: Push-to-test type unless otherwise indicated.
6. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:
1. Comply with NEMA ICS 5.
2. Provide number and type of relays required to perform necessary functions.
3. Timing Relays: Electronic.
4. Multi-Speed Motor Starters: Employ accelerating relays, decelerating relays, and compelling relays.
5. Accelerating Relays: Starts motor at low speed and then accelerates automatically through definite time intervals for each successive speed until selected speed is attained.
6. Decelerating Relays: Allows motor to decelerate automatically through definite time intervals for each successive speed until selected speed is attained.
7. Compelling Relays: Requires motor to start at low speed before a higher speed can be selected.

D. Control Power Transformers:
1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus 20VA spare capacity.
2. Include primary and secondary fuses.

E. Control Terminal Blocks: Include 25 percent spare terminals.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned enclosed motor controllers.

B. Maintain access to existing enclosed motor controllers and other installations to remain active and to require access. Modify installation or provide access panel.

C. Clean and repair existing enclosed motor controllers to remain or to be reinstalled.

3.2 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that ratings of enclosed motor controllers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed motor controllers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install motor controllers in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment components in accordance with Section 260529.

E. Install enclosed motor controllers plumb and level.

F. Provide grounding and bonding in accordance with Section 260526.

G. Install all field-installed devices, components, and accessories.

H. Provide fuses complying with Section 262813 for fusible switches as indicated.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable motor controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

K. Identify enclosed motor controllers in accordance with Section 260553.

3.4 FIELD QUALITY CONTROL

A. Division 01 – General Requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.
1. Verify motor-running protection.
2. Perform insulation-resistance tests on all control wiring with respect to ground.

E. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

F. Correct deficiencies and replace damaged or defective enclosed motor controllers or associated components.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.5 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.6 CLEANING

A. Clean dirt and debris from motor controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Division 01 – General Requirements.

B. Demonstration: Demonstrate proper operation of motor controllers to Owner, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of enclosed motor controllers and associated devices.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.8 PROTECTION

A. Protect installed enclosed motor controllers from subsequent construction operations.

END OF SECTION

SECTION 263213 - ENGINE GENERATORS

PART 1 GENERAL

1.1 SUMMARY

A. Packaged engine generator system and associated components and accessories:
   1. Engine and engine accessory equipment.
   2. Alternator (generator).
   3. Generator set control system.

B. Required emergency systems transfer switch and generator shall be configured in accordance with NFPA 70 to ensure emergency power is available within 10 seconds of failure of the normal supply. The contractor shall coordinate transfer switch time delays with the enclosed transfer switch supplier based on generator starting and stabilization time to ensure the required 10 second maximum time period is met.

C. Related Sections:
   1. Division 03 – Concrete
   2. Section 230700 - HVAC Insulation.
   3. Section 233100 - HVAC Ducts and Casings.
   4. Section 260526 - Grounding and Bonding for Electrical Systems.
   5. Section 260529 – Hangers and Supports for Electrical Systems.
   6. Section 260553 - Identification for Electrical Systems.
   7. Section 262826 - Enclosed Transfer Switches.

1.2 REFERENCES

A. ASTM D975 - Standard Specification for Diesel Fuel Oils

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NECA/EGSA 404 - Standard for Installing Generator Sets.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

F. NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment.

G. NEMA MG 1 - Motors and Generators.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

I. NFPA 30 - Flammable and Combustible Liquids Code.

J. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements

L. NFPA 110 - Standard for Emergency and Standby Power Systems.

M. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.

N. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.

O. UL 2085 - Protected Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.

P. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
      a. Transfer Switches: See Section 262826.
      b. Switchboards: See Section 262413.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
   3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Pre-installation Meeting: Convene two weeks before starting work of this section; require attendance of all affected installers.

1.4 SUBMITTALS

A. Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
   1. Include generator set sound level test data.
   2. Include characteristic trip curves for overcurrent protective devices.
   3. Include alternator thermal damage curve.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
   1. Include plan view, elevation and sections of exhaust stack including structural supports and design calculations.

D. Derating Calculations: Indicate ratings adjusted for applicable service conditions.

E. Specimen Warranty: Submit sample of manufacturer's warranty.

F. Evidence of qualifications for installer.

G. Evidence of qualifications for maintenance contractor (if different entity from installer).

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

I. Manufacturer's factory emissions certification.

J. Manufacturer's certification that products meet or exceed specified requirements.

K. Source quality control test reports.

L. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:
1. Certified prototype tests.
2. Torsional vibration compatibility certification.
3. NFPA 110 compliance certification.
4. Certified rated load test at rated power factor.

M. Manufacturer’s detailed field testing procedures.

N. Field quality control test reports.

O. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

P. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

Q. Sample maintenance contract, submitted to owner for review and approval.

R. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

S. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Division 01 – General Requirements.
2. Extra Fuses: One of each type and size.
3. Extra Filter Elements: One of each type, including fuel, oil and air.
4. Furnish one set of tools required for preventative maintenance of engine generator system. Package tools in adequately sized metal tool box.
5. Provide a full tank of fuel for each diesel generator after final testing and startup is complete.

1.5 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70 (National Electrical Code).
2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
4. NFPA 30 (Flammable and Combustible Liquids Code).

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
1. Authorized service facilities located within 100 miles of project site.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with engine generator systems of similar size, type, and complexity; manufacturer's authorized installer.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
1. Contract maintenance office located within 100 miles of project site.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

1.7 WARRANTY

A. Division 01 – General Requirements

B. Furnish service and maintenance of engine generator and transfer switch for one year from Date of Substantial Completion.

C. Furnish five year manufacturer extended warranty.

1.8 MAINTENANCE SERVICE

A. Division 01 – General Requirements

B. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for **two years from**

date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.

D. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 4 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

PART 2 PRODUCTS

2.1 SERVICE CONDITIONS

A. Provide engine generator system and associated components suitable for operation under the service conditions at the installed location, including but not limited to:
   1. Altitude
   2. Ambient Temperature
   3. Available Natural Gas Pressure

2.2 MANUFACTURERS

A. Packaged Engine Generator Set:
   1. MTU Onsite Energy
   2. Kohler Co
   3. Cummins Power Generation Inc
   4. Generac Power Systems
   5. Caterpillar Inc
   6. Substitutions: Division 01 – General Requirements

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

C. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

2.3 PACKAGED ENGINE GENERATOR SYSTEM

A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. System Description:
1. Application: Emergency & Standby.
2. Configuration: Single packaged engine generator set operated independently (not in parallel).

D. Packaged Engine Generator Set:
1. Type: Natural Gas
2. Power Rating: As indicated on drawings.
3. Voltage: As indicated on drawings.
4. Line Side Circuit Breaker(s):
   a. Type: Thermal magnetic.
   b. Trip Rating: As indicated on drawings.
      1) For 480/277V, 3PH System, circuit breakers rated 1000A or greater:
         a) Provide LSIG type circuit breaker
   c. Features:
      1) Shunt trip.
      2) Auxiliary contacts.
      3) 100% Rated
   d. Provide with two (2) breakers; one for emergency lighting transfer switch, and one for remaining standby load.

E. Generator Set General Requirements:
1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
2. Factory-assembled, with components mounted on suitable base.
3. List and label engine generator assembly as complying with UL 2200.
4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.
7. Starting and Load Acceptance Requirements:
8. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
9. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
10. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
11. Maximum Load Step: Supports 100 percent of rated load in one step.
    a. Maximum Voltage Deviation with Load Step: 15% percent.
    b. Maximum Frequency Deviation with Load Step: 15% percent.

12. Motor Starting Capability: Supports starting of motor load indicated with a maximum voltage dip of 15% percent.

F. Exhaust Emissions Requirements:
1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.

G. Mounting: Furnish unit with suitable spring-type vibration isolators and mount on structural steel base.

2.4 ENGINE AND ENGINE ACCESSORY EQUIPMENT

A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.

B. Engine Fuel System - Gaseous (Spark Ignition):
1. Fuel Source: Natural gas
a. Provide with self- adjusting fuel regulator based on manufacturer's full load operating pressure of 14" to 20" H2O.
2. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
3. Provide components/features indicated and as necessary for operation and/or required by applicable codes, including but not limited to:
a. Carburetor.
b. Gas pressure regulators.
c. Fuel shutoff control valves.
d. Low gas pressure switches.
e. Vaporizer (for propane liquid withdrawal).

C. Engine Starting System:
1. System Type: Electric, with DC solenoid-activated starting motor(s).
2. Battery(s):
a. Battery Type: Lead-acid.
b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
4. Battery Charger:
a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.

c. Recognized as complying with UL 1236.
d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
f. Provide alarm output contacts as necessary for alarm indications.

5. Battery Heater: Provide thermostatically controlled battery heater to improve starting under cold ambient conditions.

D. Engine Speed Control System (Governor):
1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
2. Multiple Engine Generator Sets Operated in Parallel: Provide electronic isochronous governors with automatic load sharing controls.
3. Generator Sets Used with Closed Transition Transfer Switches: Provide electronic isochronous governor with frequency regulation suitable for transfer.
4. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.

E. Engine Lubrication System:
1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
2. Oil Heater: Provide thermostatically controlled oil heater to improve starting under cold ambient conditions.

F. Engine Cooling System:
1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
3. Ducted Radiators: Where ducted radiator air discharge is to be field-installed, provide suitable radiator duct flange/adapter.
4. Coolant Heater: Provide thermostatically controlled coolant heater to improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

G. Engine Air Intake and Exhaust System:
1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
2. Provide output to motorized damper control, for ventilation/combustion air intake louver operation. Coordinate genset required CFM for outside air and combustion air, and ensure systems in place are adequate for proper generator operation before start up.
3. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.
4. Radiator Exhaust System: Provide solid wall galvanized steel cowling from radiator to exterior louver for generator heat exhaust. Coordinate with architect and mechanical contractor.
5. Exhaust Silencer: Provide critical grade or better exhaust silencer with sound attenuation not less than basis of design; select according to manufacturer's recommendations to meet sound performance requirements.

6. Stack Height and Emission Dispersion.
   a. All engines or turbines shall utilize an exhaust stack that discharges so as to not cause a condition of air pollution (310 CMR 7.01(1)). Exhaust stacks shall be configured to discharge the combustion gases vertically and shall not be equipped with any part or device that restricts the vertical exhaust flow of the emitted combustion gases, including but not limited to, rain protection devices such as “shanty caps” and “egg beaters”.
   b. Engines and turbines with rated power output equal to or greater than 300 kw, but less than one MW shall be equipped with an exhaust stack with a minimum stack height of ten feet above the rooftop or the engine or turbine enclosure, whichever is lower.
   c. Engines and turbines with rated power output equal to or greater than one MW shall be equipped with an exhaust stack with a minimum stack height of 1.5 times the height of the building on which the stack is located. If the stack is lower than 1.5 times the building height or lower than the height of a structure that is within 5L of the stack (5L being five times the lesser of the height or maximum projected width of the structure), an EPA Guideline air quality model shall be run to document the operation of the applicable engine or turbine will not cause an exceedance of any National Air Quality Standard..

H. Exhaust Silencer: Critical type silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions. Provide threaded rod and hangers, to solidly mount silencer and exhaust piping above generator, as per structural analysis.

I. Batteries: Heavy duty, diesel starting type lead-acid storage batteries. Match battery voltage to starting system. Furnish cables and clamps.

J. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.

K. Battery Charger: Current limiting type designed to float at 2.17 volts for each cell and equalize at 2.33 volts for each cell. Furnish overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Furnish wall mounted enclosure to meet NEMA 250, Type 1 requirements.

2.5 ALTERNATOR (GENERATOR)

A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with re-connectable leads for 3 phase alternators.

B. Exciter:
   1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
   2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300% of rated output current for 10 seconds.
   3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.
   4. Voltage Regulation (with shunt or PMG excitation): Plus/minus two percent for any constant load from no load to full load.

C. Temperature Rise: Comply with UL 2200.

D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.

E. Enclosure: NEMA MG 1, drip-proof.

F. Total Harmonic Distortion: Not greater than five percent.

G. Alternator Heater: Provide strip heater to prevent moisture condensation on alternator windings.

H. Voltage Regulation: Furnish generator mounted volts per hertz exciter-regulator to match engine and generator characteristics, with voltage regulation plus or minus 1 percent from no load to full load. Furnish manual controls to adjust voltage droop, voltage level (plus or minus 5 percent) and voltage gain.

I. Product Description: NEMA MG1, reconnectable brushless synchronous generator with brushless exciter.

J. Insulation Class: F.

K. Temperature Rise: 130 degrees C Standby.

L. Enclosure: NEMA MG1, open drip proof.

2.6 GENERATOR SET CONTROL SYSTEM

A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.

B. Control Panel:
   1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
   2. Generator Set Control Functions:
      a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
      b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
      c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
      d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
      e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
      f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
      g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
   3. Generator Set Status Indications:
      a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
      b. Current (Amps): For each phase.
      c. Frequency (Hz).
      d. Real power (W/kW).

e. Reactive power (VAR/kVAR).
f. Apparent power (VA/kVA).
g. Power factor.
h. Duty Level: Actual load as percentage of rated power.
i. Engine speed (RPM).
j. Battery voltage (Volts DC).
k. Engine oil pressure.
l. Engine coolant temperature.
m. Engine run time.
n. Generator powering load (position signal from transfer switch).

4. Generator alarm indicators and gauges:
   a. Frequency Meter: 45-65 Hz. range, 3.5 inch dial.
   b. AC Output Voltmeter: 3.5 inch dial, 2 percent accuracy, with phase selector switch.
   c. AC Output Ammeter: 3.5 inch dial, 2 percent accuracy, with phase selector switch.
   d. Engine running time meter.
   e. Oil pressure gauge.
   f. Water temperature gauge.
   g. Push-to-test indicator lamps, one each for:
      1) Low oil pressure.
      2) Low water temperature.
      3) Overspeed.
      4) Overcrank.
      5) High engine temperature.
      6) High engine temperature pre-alarm.
      7) Low fuel, main tank.
      8) Low coolant level.
      9) EPS supplying load.
      10) Control switch not in automatic position.
      11) High battery voltage.
      12) Low battery voltage.
      13) Low cranking voltage.
      14) Battery charger AC failure.
      15) Lamp test.
      16) Low starting air pressure.
      17) Low starting hydraulic pressure.
      18) Air shut-down damper (when used).
5. Additional features:
   a. Engine start/stop selector switch.
   b. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
   c. Additional visual indicators and alarms in accordance with by NFPA 110.
   d. Remote Alarm Contacts: Factory wire DPDT contacts to terminal strip for remote alarm functions in accordance with NFPA 110.

C. Remote Annunciator Panel: Flush mounted panel with brushed stainless steel. Furnish alarm horn, and indicators and alarms as follows:
1. Low oil pressure.
2. Low water temperature.
3. Overspeed.
4. Overcrank.

5. High engine temperature.
6. High engine temperature pre-alarm.
7. Low fuel, main tank.
8. Low coolant level.
9. Control switch not in automatic position.
10. Low cranking voltage.
11. Air shut-down damper (when used).
12. System ready.
13. Line power available.
14. Generator power available.
15. Lamp test and horn silence switch.

D. Remote Emergency Stop: Provide approved red, weatherproof, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

2.7 SOURCE QUALITY CONTROL

A. Division 01 – General Requirements.

B. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

C. Generator Set production testing to include, at a minimum:
1. Operation at rated load and rated power factor.
2. Single step load pick-up.
3. Transient and steady state voltage and frequency performance.
4. Operation of safety shutdowns.

D. Provide shop inspection and testing of completed assembly.

E. Make completed engine-generator assembly available for inspection at manufacturer’s factory prior to packaging for shipment. Notify Owner, Architect/Engineer at least seven days before inspection is allowed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.

B. Verify that rough-ins for field connections are in the proper locations.

C. Verify that mounting surfaces are ready to receive equipment.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Coordinate all openings in masonry for rigging genset into facility; exhaust and intake openings, with GC/CM and all related trades.

D. Install generator sets and associated accessories in accordance with NECA/EGSA 404.

E. Arrange equipment to provide minimum clearances and required maintenance access.

F. Unless otherwise indicated, mount generator set on properly sized concrete pad, minimum of 6 inches above grade, constructed in accordance with Division 03. Provide suitable vibration isolators, where not factory installed.

G. Provide required support and attachment in accordance with Section 260529.

H. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.

I. Provide natural gas piping in accordance with Division 23.

J. Provide roof cap, motorized damper(s) and duct for cooling air intake/exhaust in accordance with Division 23.

K. Provide engine exhaust piping in accordance with Division 23 where not factory installed.
   1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
   2. Do not exceed manufacturer's maximum back pressure requirements.

L. Install exhaust silencer in accordance with Division 23 where not factory installed.

M. Provide grounding and bonding in accordance with Section 260526.

N. Identify system wiring and components in accordance with Section 260553.

O. Install engraved plastic nameplates in accordance with Section 260553

   1. For Emergency Sources: A sign shall be placed at the service-entrance equipment, at the meter location, and on any equipment up to the service entrance-equipment indicating type and location of on-site emergency power sources.

   2. For Standby Sources: A sign shall be placed at the service-entrance equipment, at the meter location, and on any equipment up to the service-entrance equipment that indicates the type and location of on-site optional standby power sources.

P. Ground and bond generator and other electrical system components in accordance with Section 260526 as a separately derived system.

3.3 FIELD QUALITY CONTROL

A. Division 01 – General Requirements.

B. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

E. Provide all equipment, tools, and supplies required to accomplish inspection and testing.

F. Preliminary inspection and testing to include, at a minimum:

1. Inspect each system component for damage and defects.
2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
3. Check for proper oil and coolant levels.

G. Verify fuel gas pressure. If insufficient, make all corrections as necessary for proper operations.

H. Prepare and start system in accordance with manufacturer's instructions.

I. Perform acceptance test in accordance with NFPA 110, Paragraph 7.13: Installation Acceptance.

1. Inspection and testing to include, at a minimum:
   a. Verify compliance with starting and load acceptance requirements.
   b. Verify voltage and frequency; make required adjustments as necessary.
   c. Verify phase sequence.
   d. Verify control system operation, including safety shutdowns.
   e. Verify operation of auxiliary equipment and accessories (e.g. battery charger, heaters, etc.).
   f. Perform load tests in accordance with NFPA 110 (1.5 hour building load test followed by 2 hour full load test). Contractor shall provide load bank to simulate building load as required.

J. Provide field emissions testing where necessary for certification.

K. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

L. Submit detailed reports indicating inspection and testing results and corrective actions taken.

M. Inspect and test in accordance with NETA ATS, except Section 4.

N. Perform inspections and tests listed in NETA ATS, Section 7.22.

O. Above testing shall be documented in writing and furnished as a part of the O&M manuals, and provided to engineer prior to closeout.

3.4 ADJUSTING

A. Division 01 – General Requirements.

B. Adjust generator output voltage and engine speed to meet specified ratings.

3.5 CLEANING

A. Division 01 – General Requirements.

B. Clean engine and generator surfaces. Replace oil and fuel filters with new.

C. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. Division 01 – General Requirements

B. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.
5. Describe loads connected to emergency and standby system and restrictions for future load additions.
6. Simulate power outage by interrupting normal source, and demonstrate system operates to provide emergency and standby power.

D. After successful acceptance test and just prior to Substantial Completion, replace air, oil, and fuel filters and fill fuel storage tank.

3.7 PROTECTION

A. Protect installed engine generator system from subsequent construction operations.

END OF SECTION

SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Strike (air) terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

C. Description: Conductor system protecting entire building and having UL Master Label and/or LPI Certification.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Section 260400 – General Conditions for Electrical Trades

C. Section 260526 - Grounding and Bonding for Electrical Systems: Electrical system grounds.

D. Surge Protection for Wiring Systems: Specified in individual system requirements.

1.3 REFERENCE STANDARDS

A. NFPA 780 - Standard for the Installation of Lightning Protection Systems;

B. UL 96 - Lightning Protection Components; Current Edition, Including All Revisions.

C. UL 96A - Installation Requirements for Lightning Protection Systems.

D. Perform Work in accordance with UL 96A and furnish Master Label.

OR

E. Perform Work in accordance with LPI-175 and furnish LPI Certification.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination with Concrete Work: Coordinate the embedding of lightning protection components in concrete.

B. Coordination with Roofing Installation:
   1. Ensure adequate attachment of strike terminals and conductors without damage to roofing.
   2. Sealing and flashing of all lightning protection roof penetrations with roofing contractor.

C. Coordinate with all trades to ensure a correct, neat and unobtrusive installation.

D. Pre-installation Meeting: Convene a meeting at least two weeks prior to commencement of any work affected by lightning protection system requirements to discuss prerequisites and coordination required by other installers; require attendance by representatives of installers whose work will be affected.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. System shall be provided turn-key, design and installation.

C. Shop Drawings: Indicate location and layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.
1. Where conductors or grounds are to be embedded or concealed in other construction, submit shop drawings at least 30 days prior to start of construction.
2. If concrete-encased grounds are to be used and are not shown in the contract documents, provide sufficient data to determine concrete encasement dimensions and location.
3. Include data on actual ground resistance determined by field measurement in accordance with NFPA 780.
4. Include engineering analysis of equalization of potential to metal bodies within the structure.
5. Include access panels, test holes, and disconnecting means for maintenance.

D. Product Data: Provide dimensions and materials of each component, indication of testing agency listing, and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Installation Certification: Submit copy of certification agency's approval UL Master Label.

G. Operation and Maintenance Data: Provide recommended inspection and testing plan, including recommended intervals, to achieve periodic maintenance as recommended in NFPA 780; provide customized plan reflecting actual installation configuration with specific installed components identified.

H. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

1.6 QUALITY ASSURANCE

A. Maintain one copy of each referenced system design standard on site.

B. Manufacturer Qualifications: Company specializing in lightning protection equipment with minimum three years documented experience.

C. Designer Qualifications: Person or entity, employed by installer, who specializes in lightning protection system design with minimum three years documented experience.

D. Installer Qualifications: Capable of providing the specified certification of the installed system.

E. Installer Qualifications: Company specializing in lightning protection system design with minimum three years documented experience.

F. Field Quality Control Testing Agency Qualifications: Firm capable of and experienced in grounding and bonding testing with documented experience and minimum of three project references.

G. Products: Listed, classified, and labeled as suitable for the purpose intended.

H. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

I. Design lightning protection system under direct supervision of [NFPA 780 Certified Designer] or [Professional Engineer] experienced in design of this Work and licensed in State where work is performed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Lightning Protection Components:
   1. Advanced Lightning Technology (ALT)
   2. Harger Lightning and Grounding
   3. thermOweldae, subsidiary of Continental Industries; division of Burndy LLC;
   4. Substitutions: See Division 01- General Requirements.

2.2 LIGHTNING PROTECTION SYSTEM

A. Lightning Protection System: Provide complete system complying with NFPA 780, including air terminals, bonding, interconnecting conductors and grounding electrodes.
   1. Provide system that protects:
      a. The entire structure.
      b. Open air areas within 100 feet of exterior walls at grade level.
      c. Open air areas within building footprint.
      d. Metal fences identified on site plan.
      e. Pool areas and equipment.
   2. Coordinate with other grounding and bonding systems specified.
   3. Treat isolated non-grounded protruding metal items as specified by NFPA 780 for heavy-duty stacks.
   4. Determine ground resistance by field measurement.
   5. Provide copper, bronze, stainless steel, or aluminum components, as required to be properly installed on this structure, and its components. Do not use dissimilar metals.
   6. Provide disconnecting means and access panels or similar devices to allow complete periodic inspection and testing as described by NFPA 780 Annex D. check GR
   7. Provide materials that are galvanically compatible with the structure and system components.

8. Provide system certified by Underwriters Laboratories or the Lightning Protection Institute.
9. Conceal all downleads within structure.

B. Strike Terminals: Provide strike (air) terminals as required by delegated design

C. Strike Terminals: Provide strike (air) terminals on the following:
1. Roofs.
2. Parapets.
3. Roof mounted equipment.
4. Sports Lighting poles if within strike zone

2.3 COMPONENTS

A. All Components: Complying with applicable requirements of UL 96.

B. Strike (Air) Terminals: Copper, solid, with adhesive bases for single-ply roof installations.

C. Grounding Rods: Solid copper.

D. Ground Plate: Copper.

E. Conductors: Copper or Aluminum cable.

F. Connectors and Splicers: Bronze.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate work with installation of roofing and exterior and interior finishes.

3.2 INSTALLATION

A. Install in accordance with referenced system standards and as required for specified certification.

B. Connect conductors using mechanical connectors or exothermic welding process; protect adjacent construction elements and finishes from damage.

C. Connect conductors using mechanical connectors.

D. Connect conductors using exothermic welding process; protect adjacent construction elements and finishes from damage.

E. Downleads from roof to grade shall be routed within building envelope. Exposed downleads are not acceptable.

3.3 FIELD QUALITY CONTROL

A. See Division 01, for additional requirements.

B. Perform visual inspection as specified in NFPA 780 as if this were a periodic follow-up inspection.

C. Perform continuity testing as specified in NFPA 780 as if this were testing for periodic maintenance.

D. Obtain the services of the specified certification agency to provide inspection and certification of the lightning protection system, including performance of any other testing required by that agency.

E. Perform inspection and testing in accordance with UL 96A.

END OF SECTION

SECTION 265100 - LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Exterior luminaires.

C. Ballfield luminaires and controls.

D. Emergency lighting units.

E. Exit signs.

F. Drivers.

G. Luminaire accessories.

1.2 RELATED REQUIREMENTS

A. Section 260533 – Raceways and Boxes for Electrical Systems.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

C. Section 260923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.

D. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

E. Lighting Fixture Schedule as indicated on drawings.

1.3 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type); 2002.

C. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

D. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

E. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

F. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; 2015.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

H. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2015.

K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

L. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

M. UL 924 Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

N. UL 1598 - Luminaires; Current Edition, Including All Revisions.

O. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility, installed by other sections or others.
   4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

D. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting

requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA LM-79 and IESNA LM-80.
    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
    b. Testing Agency Certified Data: Photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    c. TM-21 report for L70 rating at color temperature specified.
6. Ballasts/drivers: Include wiring diagrams and list of compatible lamp configurations.
7. Lamps/LED arrays: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
8. Fluorescent/LED driver Emergency Power Supply Units: Include a list of compatible lamp configurations and associated lumen output.
9. Air Handling Luminaires: Include air handling performance data.

E. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

F. Samples:
1. Provide one sample(s) of each specified luminaire upon request.
2. Provide one sample(s) of each custom luminaire.
3. Provide one sample(s) of each luminaire proposed for substitution upon request.
4. Provide one sample(s) of each product finish illustrating color and texture upon request.
5. Provide a mockup of selected luminaires upon request.
6. Submit two color chips 3 x 3 inch in size illustrating luminaire finish color where indicated in luminaire schedule.

G. Certificates for Dimming Ballasts/Drivers: Manufacturer's documentation of compatibility with dimming controls to be installed.

H. Field quality control reports.

I. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.6 EXTRA PRODUCTS

A. Provide 6 universal exit signs complete with all labor and materials required for installation as directed by the Local Authority Having Jurisdiction.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 – General Requirements.
   2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
   3. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
   4. LED Drivers: Furnish two of each driver type

C. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8 QUALIFICATION DATA: For testing laboratory providing photometric data for luminaires.

A. Seismic Qualification Certificates: For luminaires, 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.

B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

1.9 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.10 FIELD CONDITIONS

A. Maintain field conditions within the manufacturers required service conditions during and after installation.

1.11 WARRANTY

A. See Division 01 – General Requirements.

B. Section 260400 – General Requirements for Electrical Trades.

C. Unless otherwise noted in Lighting Fixture Schedule, Provide three year manufacturer warranty for all LED luminaires, including drivers.

D. Provide two year manufacturer warranty for all linear fluorescent ballasts.

E. Provide five year manufacturer warranty for batteries for emergency lighting units.

F. Provide ten year manufacturer warranty for batteries for self-powered exit signs.

G. Provide five year manufacturer warranty for fluorescent and LED Driver emergency power supply units.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in Lighting Fixture Schedule included on the drawings.

B. Substitutions: See Division 01- General Requirements, except where individual luminaire types are designated with substitutions not permitted and the following:
   1. Section 260400 – Product Requirements and as follows:
      a. Approved equals to the basis of design fixture as listed in the Lighting Fixture Schedule shall be accepted for review with the proposed substitute fixture meeting the following minimum requirements:
         1) Be of the same general size, style and shape, including but not limited to lens construction and shading.
         2) Be of equal or better quality and construction.
         3) Be supplied with all required accessories to match the specified fixture.
         4) Be supplied with all remote drivers, power supplies and cabling lengths to meet specified performance and control.
         5) Provide the same or better distribution, efficiency, source lumen output, and L70 lumen depreciation metric.
      b. Provide point by point photometric calculations at the request of the Engineer for evaluation.
      c. The basis of design fixture listed in the Lighting Fixture Schedule lists part numbers, specifications, options, accessories and source output available at the time of design. Substitutions shall meet these requirements as scheduled.
      d. The evaluation of an approved equal shall be at the sole discretion of the Architect and Engineer.

2.2 INTERIOR LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Provide products complying with Federal Energy Management Program (FEMP) requirements.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, drivers, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Recessed Luminaires:
1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

J. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

K. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

L. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

M. Luminaires in Special Environments:
1. Showers: Provide with non-conductive trim.
2. Wet Locations: Provide with sealed and gasketed lens.
3. Infectious Environments: Provide with sealed and gasketed lens and anti-microbial finish.
4. Pool Chemical Rooms: Provide with sealed and gasketed lens, IP65 Rating and clean room rating.

2.3 EXIT SIGNS

A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
1. Number of Faces: Single or double as indicated or as required for the installed location.

2. Directional Arrows: Universal type for field adjustment sized so that they are clearly visible at a distance of 40 feet as required by local codes.
3. Mounting: Wall, ceiling or pendant as indicated. Provide universal mount exit signs where indicated.
4. Housing: Varies, refer to Lighting Fixture Schedule.
5. Face: Varies, refer to Lighting Fixture Schedule.

B. Self-Powered Exit Signs:
1. Product Description: UL 924 self-contained emergency lighting unit.
2. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
3. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
4. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
5. Provide low-voltage disconnect to prevent battery damage from deep discharge.
6. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

C. Self-Luminous Exit Signs: Internally illuminated by tritium gas sealed inside phosphor lined gas tubes, requiring no electrical power to operate, with a service life of 20 years unless otherwise indicated.

D. Photoluminescent Exit Signs: Powder-coated sheet aluminum with photoluminescent pigmented material.

E. Special Wording Signs: Provide with special wording as indicated.
1. Where indicated, provide with international symbol of accessibility complying with state and local codes.
2. Provide combination exit/special wording signs where indicated.

F. Accessories:
1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
2. Provide compatible accessory wire guards where indicated.

2.4 EXTERIOR LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Provide products complying with Federal Energy Management Program (FEMP) requirements.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, drivers, reflectors, lenses, housings, poles, brackets, bases, vibration dampers, isolation pads and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Provide IESNA full cut-off classified products unless otherwise indicated or provide products with backlight, uplight and glare (BUG) ratings as indicated.

I. Provide products with IESNA light distribution as indicated.

J. Provide products with internal/external house-side shields as indicated.

K. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data or as indicated.

L. Poles:
1. Material and Finish: Refer to Lighting Fixture Schedule.
2. Accessories:
   a. Handhole.
   b. Anchor bolts.
   c. Base Cover.
   d. Decorative base.
   e. Pre-drilled for luminaire mounting.
   f. Banner arms.
   g. Integral GFI receptacle.
3. Loading Capacity Ratings:
   a. Provide with EPA rating suitable for maximum wind load in area, including EPA for attached luminaires and all required accessories.
   b. Consult with local authorities for wind loading requirements.

2.5 BALLFIELD LUMINAIRES AND CONTROLS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Provide products complying with Federal Energy Management Program (FEMP) requirements.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, drivers, reflectors, lenses, housings, poles, controls, brackets, bases, vibration dampers, isolation pads and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Provide IESNA full cut-off classified products unless otherwise indicated or provide products with backlight, uplight and glare (BUG) ratings as indicated.

I. Provide products with IESNA light distribution as indicated.

J. Provide products with internal/external house-side shields as indicated.

K. Provide products that will provide the following light levels:

1. Field #3: 51 Foot Candles on the infield of the 215' x 215' x 211’ field and 30 Foot Candles on the outfield

2. Odom's Field: 52 Foot Candles on the infield of the 215' R field and 30 Foot Candles on the outfield

3. Teddy's Field: 50 Foot Candles on the infield of the 257-200' field and 30 Foot Candles on the outfield

4. Civic Lawn Area: 32 Foot Candles on the 275' x 140' area

5. Double Tennis: 32 Foot Candles on the two (2) tennis courts

6. Basketball Area: 33 Foot Candles on the basketball area

7. Competition Pool: 54 Foot Candles on the competition pool

8. Family Pool/Pool Deck: 32 Foot Candles on the family pool and pool deck

L. System Components:

1. GameChanger Gen 3 Full fixtures pre-aimed, pre-wired and fully assembled on light stanchion. UL-Listed driver/distribution cabinet - containing a surge protector and power line filter - that is fully-assembled, fully-wired and to be mounted 10' above grade. (10F - 8 Fixtures) One on Poles B2 and E2-4

2. GameChanger Gen 3 Full fixtures pre-aimed, pre-wired and fully assembled on light stanchion. UL-Listed driver/distribution cabinet - containing a surge protector and power line filter - that is fully-assembled, fully-wired and to be mounted 10' above grade. (10F - 7 Fixtures) One on Pole E1

3. GameChanger Gen 3 Full fixtures pre-aimed, pre-wired and fully assembled on light stanchion. UL-Listed driver/distribution cabinet - containing a surge protector and power line filter - that is fully-assembled, fully-wired and to be mounted 10’ above grade. (7F - 6 Fixtures) One on Poles 81 and C1-2.

4. GameChanger Gen 3 Full fixtures pre-aimed, pre-wired and fully assembled on light stanchion. UL-Listed driver/distribution cabinet - containing a surge protector and power line filter - that is fully-assembled, fully-wired and to be mounted 10’ above grade. (7F - 5 Fixtures) One on Poles A1, B2 and C2.

5. GameChanger Gen 3 Full fixtures pre-aimed, pre-wired and fully assembled on light stanchion. UL-Listed driver/distribution cabinet - containing a surge

protector and power line filter - that is fully-assembled, fully-wired and to be mounted 10’ above grade. (7F - 4 Fixtures) One on Poles A2-3, A5 and P3 and two on Pole A4.

6. GameChanger Gen 3 Full fixtures pre-aimed, pre-wired and fully assembled on light stanchion. UL-Listed driver/distribution cabinet - containing a surge protector and power line filter - that is fully-assembled, fully-wired and to be mounted 10’ above grade. (4F - 3 Fixtures) One on Poles BB1 and T2

7. GameChanger Gen 3 Full fixtures pre-aimed, pre-wired and fully assembled on light stanchion. UL-Listed driver/distribution cabinet - containing a surge protector and power line filter - that is fully-assembled, fully-wired and to be mounted 10' above grade. (2F-2 Fixtures) One on Poles P1-2 and T1.

8. GameChanger Gen 3 Small fixtures pre-aimed, pre-wired and fully assembled on light stanchion. UL-Listed driver/ distribution cabinet - containing a surge protector and power line filter - that is fully-assembled, fully-wired and to be mounted 10’ above grade. (7F - 5 Fixtures) One on Pole BB1.

9. GameChanger Gen 3 Small fixtures pre-aimed, pre-wired and fully assembled on light stanchion. UL-Listed driver/ distribution cabinet - containing a surge protector and power line filter - that is fully-assembled, fully-wired and to be mounted 10’ above grade. (4F - 3 Fixtures) One on Pole B2, P2, T1 and T3-4.

10. GameChanger Gen 3 Small fixtures pre-aimed, pre-wired and fully assembled on light stanchion. UL-Listed driver/ distribution cabinet - containing a surge protector and power line filter - that is fully-assembled, fully-wired and to be mounted 10' above grade. (2F - 2 Fixtures) One on Poles P1 and T2.

11. GameChanger Gen 3 Small fixture pre-aimed, pre-wired and fully assembled on light stanchion. UL-Listed driver/distribution cabinet - containing a surge protector and power line filter - that is fully-assembled, fully-wired and to be mounted 10' above grade. (1F - 1 Fixture) One on Pole P3.

M. Provide the following additional components for a complete system:

1. Stainless Steel Cabinet (31)

2. On/Off GameChanger” Switches (7)

3. The OLED GameChanger" Silver Dynamic Lighting Package includes two (2) preset scenes: Chaser and Score.

4. OLED Wireless GameChanger”” Control System

5. Field Audit (7)

6. GameChanger Full Visor Blackout - 1200W (31)

7. GameChanger Full Visor - 1200W (78)

8. GameChanger Full Visor - 600W (25)

9. 25-Year, Maintenance-Free Warranty (1)

N. Provide design services including foundation design in accordance with FBC 2020 wind load requirements.

2.6 MATERIALS

A. Parts:
1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.
4. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
5. Diffusers and Globes:
   a. Refer to Interior Lighting Fixture Schedule for types.
   b. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   c. Glass: Annealed crystal glass unless otherwise indicated.
   d. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
6. Housings:
   a. Extruded-aluminum housing and heat sink unless otherwise indicated.
   b. Powder-coat finish unless otherwise indicated, color selection by Architect.
7. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   a. Label shall include the following lamp characteristics:
      1) “USE ONLY” and include specific lamp type.
      2) Lamp diameter, shape, size, wattage, and coating.
      3) CCT and CRI for all luminaires.

B. METAL FINISHES

1. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.7 DRIVERS

A. Manufacturers:
1. eldoLED.
2. General Electric Company.
3. Lutron Electronics Company.
4. Osram Sylvania.
5. Philips Lighting Electronics/Advance.
6. Substitutions: See Division 01- General Requirements, Product Requirements.
7. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
8. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.
9. Provide ballasts/drivers compatible with the approved lighting control systems.

B. Drivers - General Requirements:
1. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
2. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

C. LED Drivers:
1. Product Description: LED dimming driver.
   a. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
   b. Digital (DALI Low Voltage Controlled) Dimming Drivers
   c. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers
2. General:
   a. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
   b. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
   c. Driver must limit inrush current.
      1) Base specification: Meet or exceed NEMA 410 driver inrush standard of 430 Amps per 10 Amps load with a maximum of 370 Amps (^2) – seconds.
      2) Preferred Specification: Meet or exceed 30mA(^2)s at 277VAC for up to 50 watts of load and 75A at 240us at 277VAC for 100 watts of load.
   d. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
   e. No visible change in light output with a variation of plus/minus 10 percent line voltage input.

f. Total Harmonic Distortion less than 20% percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.

g. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
   1) Adjustment of forward LED voltage, supporting 3V through 55V.
   2) Adjustment of LED current from 200mA to 1.05A at the 100 percent control input point in increments of 1mA
   3) Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.

h. Driver must be able to operate for a (+/- 10%) supply voltage of 120V through 277VAC at 60Hz.

i. Driver should be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.

j. Driver shall include ability to provide no light output when the analog control signal drops below 0.5 V, or the DALI/DMX digital signal calls for light to be extinguished and shall consume 0.5 watts or less in this standby. Control deadband between 0.5V and 0.65V shall be included to allow for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.

3. Light Quality
   a. Over the entire range of available drive currents, driver shall provide step-free, continuous dimming to black from 100 percent to 1 percent and 10% relative light output where indicated, or 100 – 10% light standard. Driver shall respond similarly when raising from 1% to 100%
   b. 1) Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels
   c. Drivers to track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.
   d. Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-1 percent luminaire shall have:
      1) LED dimming driver shall provide continuous step-free, flicker free dimming similar to incandescent source.
      2) Base specification: Flicker index shall less that 5% at all frequencies below
      3) 1000 Hz.
      4) Preferred specification: Flicker index shall be equal to incandescent, less that 1% at all frequencies below 1000 Hz.

4. Control Input
   a. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
      1) Must meet IEC 60929 Annex E for General White Lighting LED drivers
      2) Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
      3) Must meet ESTA E1.3 for RGBW LED drivers

b. Digital (DALI Low Voltage Controlled) Dimming Drivers
   1) Must meet IEC 62386
c. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers
   1) Must meet DMX / RDM: USITT DMX512A and ANSI E1.20 (Explore & Address)
   2) Capable of signal interpolation and smoothing of color and intensity transitions

5. Driver: Approved by dimming system manufacturer as suitable for operation with control unit and suitable for LED source type and quantity specified for luminaire.

2.8 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 “Hangers and Supports for Electrical Systems” for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with heavy duty swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage minimum.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

F. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533 as required for installation of luminaires, emergency lighting units and exit signs provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
   a. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
5. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box, heavy-duty swivel hangers and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
6. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
7. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
8. See Division 09 - Finishes where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.
2. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
3. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
4. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
5. Install recessed luminaires to permit removal from below.

H. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet (1.2 m) between supports.
4. Install canopies tight to mounting surface.

5. Secure pendant-mounted luminaires to building structure.
   a. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
6. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box, heavy-duty swivel hangers and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
7. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
8. Unless otherwise indicated, support pendants from swivel hangers.

I. Exterior Luminaires:
1. Install concrete bases for lighting poles at locations as indicated on Drawings, in accordance with Division 03 - Concrete.
2. Verify foundations are ready to receive luminaires.
3. Install poles plumb. [Install [shims] [double nuts] to adjust plumb. Grout around each base.
4. Set pole with integral handhole 180 degrees opposite of drive lane, parking lot or curb line.
5. Install vibration dampers and isolation pads as indicated.
6. Install lamps in each luminaire.
7. Bond and ground luminaries [metal accessories] [and] [metal poles] in accordance with Section 260526.
8. Aim and adjust luminaires with distribution aimed towards coverage area and parallel to curb line or to provide illumination levels and distribution as indicated.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Install accessories furnished with each luminaire.

L. Bond products and metal accessories to branch circuit equipment grounding conductor.

M. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.
3. Install plumb and adjust to align with building lines and with each other. Secure to prevent movement.
4. Install suspended exit signs using pendants from swivel hangers. Install pendant lengths required to suspend sign at height indicated or as instructed by the Authority Having Jurisdiction.

N. Remote drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

O. Identify luminaires connected to emergency power system in accordance with Section 26 0553.

P. Install specified lamps in each luminaire.

Q. Install accessories furnished with each luminaire.

R. Connect luminaires to branch circuit using flexible conduit, except for emergency lighting which shall be in conduit completely.

S. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

T. Ground and bond interior luminaires in accordance with Section 260526.

3.4 FIELD QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Air-Handling Luminaires with Air Control Blades or Heat Removal Dampers: Adjust as indicated or as required for proper airflow as directed by Architect.

D. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean photometric surfaces as recommended by the manufacturer.

3.7 CLOSEOUT ACTIVITIES

A. See Division 01- General Requirements

B. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

C. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wire.
   2. Mechanical connectors.
   3. Exothermic connections.

B. Related Sections:
   1. Section 260526 – Grounding and Bonding for Electrical Systems.
   2. See Division 01 – General Requirements.

1.2 REFERENCES

A. Building Industry Consulting Service International, Inc.
   1. BICSI TDM Manual - Telecommunications Distribution Methods Manual.

B. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

C. Telecommunication Industry Association/Electronic Industries Alliance:
   1. TIA/EIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.3 SYSTEM DESCRIPTION

A. Communications grounding systems use the following elements as grounding electrodes:
   1. Building grounding electrode.

B. Do not use the following elements as grounding electrodes:
   1. Building plumbing system.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Submit data on grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Installation Instructions: Submit for active electrodes.

E. Manufacturer's Certificate: Certify meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. See Division 01 – General Requirements.

B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding, surge protection and lightning protection of telecommunications system in accordance with latest version of Grounding, Bonding and Electrical Protection chapter of the BICSI TDM Manual, TIA/EIA 607, and NFPA 70.

B. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum three years experience approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.10 COORDINATION

A. See Division 01 – General Requirements.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 PRODUCTS

2.1 WIRE

A. Material: Stranded copper.

B. Grounding Conductor: Copper conductor bare.

C. Bonding Conductor: Copper conductor bare.

2.2 MECHANICAL CONNECTORS

A. Manufacturers:
1. Copperweld, Inc.
2. Erico, Inc.
3. O-Z Gedney Co.
4. Thomas & Betts, Electrical
5. Substitutions: See Division 01 - General Requirements.

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.3 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Cadweld, Erico, Inc.
2. Copperweld, Inc.
3. ILSCO Corporation.
4. O-Z Gedney Co.
5. Thomas & Betts, Electrical.
6. Substitutions: See Division 01 - General Requirements.

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.2 INSTALLATION

A. Install in accordance with BICSI TDM Manual, TIA/EIA 607, and NFPA 70.

B. Provide grounding/bonding for each communication rack using #4 AWG THHN, rated for 90 degrees C, insulated, copper stranded conductor. Terminate to copper communication grounding Bar in each telecommunications room.

C. Bond main telecommunications grounding system to building grounding electrode system at main electrical service entrance location with #3/0 AWG THHN, rated for 90 degrees C, insulated, copper stranded conductor.

D. Routing of grounding conductor shall be as short and direct as practical.

E. Install routing of bonding conductors with minimum number of bends and splices. Use sweeping bends.

F. Install bonding connections with listed bolts, crimp pressure connectors, clamps, or lugs.

G. Within each MDF/IDF room, provide ground bar mounted to isolating stand offs, with pre-drilled holes for accepting cable spade lugs. Each ground bus shall connect to the next with #3/0 AWG insulated green wire, and the final termination shall be at the main demarc location.

H. Position busbars near associated equipment and insulate from supports.

I. Construct busbars of copper, 4 inches x 8 inches by 1/4 inch thick with pilot holes for ground lug.

J. Bond backbone cabling at each sheath opening.

K. Ground/bond data cabinets, racks, cable trays.

L. Conduit stub/sleeves shall be installed with ground bushings and form a continuous bonded surface.

M. Install ground from each piece of equipment to grounding bar via an insulated cable no smaller than 6 AWG stranded copper wire. Install proper grounding lug on cable where connecting to racks and grounding bar.

N. Label grounding conductors and grounding bus bars in accordance with BICSI guidelines.

O. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.3 FIELD QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Visually inspect from each bus bar to main grounding electrode service location.

C. Test in accordance with BICSI TDM Manual, TIA/EIA 607, and NFPA 70.

D. When improper grounding is found, check entire project and correct. Perform retest.

END OF SECTION

SECTION 270529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for communications equipment, conduit, cable, boxes, and other communications work.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Division 03 - Cast-in-Place Concrete: Concrete equipment pads.

C. Section 260400 – General Conditions for Electrical Trades

D. Section 260529 – Hangers and Supports for Electrical Systems

E. Section 271000 – Structured Cabling

1.3 REFERENCE STANDARDS

A. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. See Division 01: General Requirements.

B. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components being installed.
   2. Coordinate the work with other trades and provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

C. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Division 03.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualifications: Include evidence of compliance with specified requirements.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with latest adopted version of applicable building code, including any addendum or supplements.

C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

D. Installer Qualifications for Field-Welding: As specified in Section 260400 General Requirements for Electrical Trades.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 Refer to Section 260529 – Hangers and Supports for Electrical Systems. All Part 2 Product requirements listed in this Section shall also apply to Division 27 Communications, except where specified otherwise herein.

2.2 J-HOOK SUPPORTS

A. Manufacturers:
1. Easton/Cooper B-Line – "BCH" Series
2. Caddy
3. Chatsworth
4. Substitutions: Division 01 - General Requirements

B. Product Description: Low-voltage and communication fasteners for routing of cabling from telecommunication room to work area outlet. J-hooks shall support all communications cabling in the project. Including, but not limited to, Category 6, 6A, fiber, speaker cabling, coaxial, security, and others.

C. Specifications:
1. Pre-galvanized steel finish
2. Static load capacity: 30 lbs
3. Quick latching cable retainer

D. Furnish with all required connectors, fasteners and accessories.

E. J-Hooks shall be sized to correctly support the number of cables, which pass through them. Under no circumstances shall cable quantity exceed 50 in any given support. Fill capacity shall be as required by code for conduit. That is to say that every J-Hook shall have a maximum of 40 percent fill capacity. Install additional supports as required.

PART 3 EXECUTION

3.1 Refer to Section 260529 – Hangers and Supports for Electrical Systems. All Part 3 Execution requirements listed in this Section shall also apply to Division 27 Communications, except where specified separately herein.

3.2 INSTALLATION – COMMUNICATIONS SYSTEM SUPPORT COMPONENTS

A. Backboxes for communications devices shall be permitted to be supported from a grid ceiling. A tile bridge shall be furnished for this purpose. Refer to Section 260533.

B. Overhead speakers, plenum boxes, audiovisual equipment, and other devices weighing more than a standard electrical backbox shall be supported via a threaded rod fastened to the building structure.

C. J-hooks shall be furnished with cable-to-beam fasteners and shall be fastened to the building structure.

D. Separate J-hooks shall be furnished and installed for different systems. The following systems shall be routed in separate j-hook pathways:
1. Data cabling
2. Speaker cabling
3. Security cabling

E. J-hook pathways shall be separated from power cabling by a minimum of 12 inches.

F. J-hook pathways shall be separated from the load side wiring of dimmer controls by a minimum of 24 inches.

END OF SECTION

SECTION 270533 - RACEWAY AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Raceway and Boxes for Communications Systems.

B. Related Sections:
   1. Section 260400 – General Conditions for Electrical Trades.
   2. Section 260526 - Grounding and Bonding for Electrical Systems.
   3. Section 260533 - Raceway and Boxes for Electrical Systems.
   4. Section 260534 - Floor Boxes for Electrical Systems.
   5. Section 270529 - Hangers and Supports for Communications Systems.
   6. Section 270553 - Identification for Communications Systems.

1.2 REFERENCES

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC);

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S);

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A);

D. NECA 1 - Standard for Good Workmanship in Electrical Construction;

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT);

F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit;

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC);

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable;

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit;

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit;

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing;

L. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT);

M. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

N. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

O. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

R. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

S. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

T. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

U. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

V. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

W. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

X. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

Y. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

Z. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

AA. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

BB. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

CC. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

1.3 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.

4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for all conduits and fittings outlined in Part 2.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

D. Shop Drawings:
1. Indicate proposed arrangement for conduits to be installed within or under structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

E. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs (where permitted), and conduits 2 inch trade size and larger.

F. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

G. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Division 01 – General Requirements.
2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

D. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

1.8 COORDINATION

A. See Division 01 – General Requirements

B. Coordinate installation of outlet boxes for equipment connected under Section 260503.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

D. Communications contractor is responsible to fully coordinate with the site and concrete contractors and all other trades when routing conduit underslab. Routing of conduit underslab may be acceptable, provided spacing of conduits is adequate for proper backfilling of area surrounding conduits. Adequate spacing shall mean using factory made conduit spacers that allow for a minimum of 3-inches for backfilling with sand or 3 times the pipe diameter for backfilling with a structural fill. Proposed conduit routing, installation and methods and backfilling procedures shall be submitted to the Engineer for review prior to installation.

PART 2 PRODUCTS

2.1 Refer to Section 260533 – Raceway and Boxes for Electrical Systems. All Part 2 Product requirements listed in this Section shall apply to Division 27 Communications.

PART 3 EXECUTION

3.1 Refer to Section 260533 – Raceway and Boxes for Electrical Systems. All Part 3 Execution requirements listed in this Section shall apply to Division 27 Communications.

END OF SECTION

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Communication system identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

1.2 RELATED REQUIREMENTS (follow the most currently adopted amended version)

A. See Division 01 – General Requirements

B. Division 09 - Finishes.

C. Section 260400 – General Conditions for Electrical Trades.

D. Section 260553 – Identification for Electrical Trades.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

C. NFPA 70 - National Electrical Code.

~~D.~~ NFPA 70E - Standard for Electrical Safety in the Workplace

E. UL 969 - Marking and Labeling Systems.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.8 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature and humidity is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 Refer to Section 260553 – Identification for Electrical Systems. All Part 2 Product requirements listed in this Section shall also apply to Division 27 Communications.

PART 3 EXECUTION

3.1 Refer to Section 260553 – Identification for Electrical Systems. All Part 3 Execution requirements listed in this Section shall also apply to Division 27 Communications, except where specified separately herein.

3.2 INSTALLATION – COMMUNICATIONS SYSTEM LABELING

A. Label Installation:
1. All labeling standards shall be confirmed with and approved by owner’s IT staff prior to performing work. It is the responsibility of the contractor to coordinate with owner’s staff.
2. Labeling procedures shall meet TIA/EIA 568B Series standard and BICSI Standards and shall be pre-approved by the Owner.
3. Permanently label, using pre-printed labels, all cables and terminations.
   a. Patch panels and cross-connect blocks, numerically from top to bottom.
   b. Patch panel port with work area outlet label.
   c. Cable segments.

4. Install label parallel to equipment lines.
5. Use industry standard TIA/EIA and BISCI color codes.
6. Each work station outlet jack and corresponding patch panel port shall be marked with the same, unique label.
7. Mark the plate with standard nomenclature as required by the configuration. Mark the outlet plainly and neatly with its station identification, as indicated in above paragraph. The station identification shall also be marked inside the outlet plate on the backing plate of the outlet, and shall match the ID used at the patch panel port. Make the outlet marking using the Panduit system or equal, except for the inside marking which may be by indelible marker. Place exposed marking on outlet plates under a transparent window for protection. Label cable with permanent marker compliant with EIA/TIA 606, six (6) inches back from the termination at both ends.

B. Wire Label Installation:
1. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
2. Install labels at data outlets identifying patch panel and port designation as specified.

C. Conduit Marker Installation:
1. Install conduit marker for each conduit longer than 10 feet.
2. Conduit Marker Spacing: 20 feet on center.

END OF SECTION

SECTION 271000 - STRUCTURED CABLING

PART 1 GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections with DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

B. Attention is directed Section 26 0400 – GENERAL CONDITIONS FOR ELECTRICAL TRADES, which is hereby made a part of this Section of the Specifications.

1.2 SUMMARY

A. Section includes communications equipment room fittings, communications backbone cabling, communications horizontal cabling, work area outlets, patch cabling, connecting cords, devices and adapters.

B. Section also includes uninterruptible power supplies for communications equipment rooms.

C. Related Sections:
1. Division 01 – General Requirements
2. Section 260400 – General Conditions for Electrical Trades
3. Section 260526 – Grounding and Bonding
4. Section 270529 – Hangers and Supports for Communications Systems
5. Section 270533 – Conduit and Backboxes for Communications Systems
6. Section 270553 – Identification for Communications Systems

1.3 REFERENCES

A. All wire and components supplied and installed shall meet the requirements of the following and all sub-referenced documents:
1. The National Electrical Code, Article 800.
2. International Electrical Testing Association:
   a. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
3. National Fire Protection Association:
   a. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
4. Underwriters Laboratories, Inc.:
   a. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces.

B. All components supplied and installed shall meet the requirements of the following standards set forth by the Telecommunications Industry Association/ Electronic Industries Alliance:
1. TIA/EIA-569-C – Telecommunications Pathways and Spaces.
2. TIA/EIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises.
3. TIA/EIA-568-C.1 – Commercial Buildings Telecommunication Cabling Standard.

4. TIA/EIA-568-C.2 – Balanced Twisted Pair Telecommunications Cabling and Components Standard.
5. TIA/EIA 568-C.3 – Optical Fiber Cabling Components.
6. TIA/EIA-607-B – Generic Telecommunications Bonding and Grounding for Customer Premises.

1.4 SYSTEM DESCRIPTION

A. Entrance Facilities: Empty raceway, boxes, etc. from utility pole to telecommunications demarcation point.

B. Backbone pathway: Conform to TIA/EIA 569 using conduit, sleeves, J-Hooks, and other methods indicated on drawings.

C. Horizontal pathway: Conform to TIA/EIA 569 using conduit, sleeves, J-Hooks, and other methods indicated on drawings.

D. Backbone cabling: Inter-building and intra-building cable connections in structured cabling between entrance facilities, equipment rooms and telecommunications closets. Backbone cabling consists of the transmission media, main and intermediate cross-connects and terminations at these locations.

E. Horizontal cabling: Cable connections in structured cabling between equipment rooms/ telecommunications closets to the work area outlet. Horizontal cabling consists of the transmission media, main and intermediate cross-connects and terminations at these locations.

F. Structured Cabling system shall include equipment room fittings, racks, cabinets, and accessories.

G. Wireless Access Points

H. System shall be completely tested, certified and warrantied as specified herein.

I. System shall include record drawings and documentation.

J. System shall include operation and maintenance instruction manuals.

1.5 SUBMITTALS

A. Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for all products specified herein. Include detailed information on equipment construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, performance, installed accessories, and compatibility; include model number nomenclature clearly marked with all proposed features.

C. Test Reports: Indicate procedures and results for specified field testing and inspection.

D. Cabling Diagram: Submit for approval a complete single line cabling diagram for the building. This diagram shall include types and quantities of backbone and horizontal cabling to be installed throughout the building. Quantities to each individual work area outlet are not required to be shown in this cabling diagram; typical cable types are

acceptable for this purpose. Include types of connectors at both ends of cabling. Include part numbers within this diagram.

E. Submit for review installer qualifications as specified herein.

F. Submit for approval a typical work area outlet panel diagram with labeling, AFTER coordination with Owner to verify labeling standard. All labels shall be coordinated with the Owner as specified herein, and in Section 270553.

1.6 CLOSEOUT SUBMITTALS

A. Division 01- General Requirements.

B. Project Record Documents: Record actual locations and sizes of pathways and outlets.

C. Submit as-built drawings for review.

D. Submit operations and maintenance data for review.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum THREE YEARS documented experience.

B. UL Compliance: The communication system supplied shall be listed by Underwiters' Laboratories under the UL Standard 1459 for Telephone Appliances and Equipment. A copy of the UL listing card for the proposed system shall be included with the contractor's submittal.

C. FCC Approval: The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems that are not FCC approved or that utilize intermediary devices for connection, shall not be considered. Provide FCC registration number of the system being proposed as part of the submittal process.

D. Installer: Company specializing in installing products specified in this section with minimum three years documented experience, and with service facilities within 50 miles of project.
   1. Evidence of ability: Furnish training certifications. Certified training shall be industry recognized at least equal to:
      a. Building Industry Consulting Service international, Inc (BICSI).
      b. Ortronics Certified installer.
      c. Hubbell Certified installer.
      d. Leviton Certified Installer.
      e. Siemon Cabling System Certified Installer.

E. Provide a full time, on-site Project manager to supervise the project.

F. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

1.8 PRE-INSTALLATION MEETINGS

A. Division 01– General Requirements.

B. Convene minimum THREE WEEKS prior to commencing work of this section.

1.9 EXTRA MATERIALS

A. Division 01 – General Requirements.

B. Furnish ten single gang 4-port face plates.

C. Furnish ten communications outlet jacks of each type.

D. Furnish 2-48 port patch panels.

E. Furnish 2-horizontal wire managers.

F. Furnish five of each length and type of patch cords.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.11 COORDINATION

A. Coordinate the installation of cable and equipment with other construction activities and the work of other sections.

B. Pre-installation Conference: Conduct conference at project site to comply with requirements in Division 01.

C. Coordinate with utility company, relocation of overhead of underground lines interfering with construction.

D. Contact utility company and coordinate installation of communication services to the building. Contractor is responsible for this coordination. Costs associated with utility company service cabling installation and startup shall be paid for by the Owner and are not part of this contract.

1.12 WARRANTY

A. Provide a warranty for minimum one (1) year against defects in material and workmanship on all components, equipment, software, systems, cabling, etc. as specified herein.

B. Data Cabling Warranty: provide a manufacturer's data cabling twenty-five (25) year system performance warranty for the voice and data structured cabling system.
   1. The Contractor shall provide documented proof that he/she is authorized and certified and in good standing with the manufactures to provide this warranty.
   2. The contractor shall provide a written 25-year warranty from the manufacturer at substantial completion of the project.
   3. The warranty shall include connecting hardware products and installed cable as part of the data cabling system warranty.
   4. The data cabling system shall include:
      a. Work area outlets.
      b. Horizontal cable.

c. Backbone cable.
d. The connecting hardware in the horizontal cross-connect.
e. The equipment patch cord at the work area outlet.
f. The patch cord at the horizontal cross-connect.

5. The manufacturer's warranty shall guarantee that the data cabling system shall be free from defects in materials and workmanship for the duration of the warranty.

PART 2 PRODUCTS

2.1 FIBER OPTIC BACKBONE CABLE

A. Manufacturers:
1. Hitcahi Cable America, Inc. – Armored Indoor/Outdoor Fiber
2. Siemon
3. Hubbell
4. Mohawk/Belden
5. Substitutions: Division 01 – General Requirements.

B. Provide quantity of multi-mode and single-mode strands as indicated on drawings.

C. All cabling shall meet or exceed Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA 568-C.3: Optical Fiber Cabling Components.

D. Description:
1. Multi-mode fiber optic cable shall be TIA type OM4, with 50/125 nominal core/ cladding diameter.
2. Single mode fiber optic cable shall be TIA type OS2, with 9/125 nominal core/cladding diameter.
3. All fiber strands shall be encased within aluminum or steel spirally wrapped armor in an interlocking configuration. The cable shall then be covered with a plenum or riser rated jacket to prevent snags during installation.
4. All fiber optic cabling shall be indoor/outdoor rated.
5. Fiber cables shall have color-coded buffered fibers, per TIA/EIA-568B, for easy identification. The fiber shall comply with ANSI/EIA/TIA-492AAAA. Fiber cable installed within buildings is to be sheathed in flame retardant outer jacket and be plenum rated. Each cabled fiber shall meet the graded performance specifications as follows:

Wavelength (nm)	Max. Atten. (dB/km)	Max. Transmission Capacity (MHz-km)
Multi-mode		
850	3.0	2000
1300	1.0	500

Wavelength (nm)	Max. Atten. (dB/km)	Max. Transmission Capacity (MHz-km)
Single-mode		
1310	0.40	100 Terahertz-km
1550	0.25	100 Terahertz-km

E. Fiber Innerduct: Provide for all fiber optic cabling. Innerduct shall be plenum rated.

1. Quantities Required: Innerduct runs do not have to be continuous throughout, breaks are expected at the pull boxes. Contractor is responsible for determination of actual lengths of innerduct required. Enough innerduct shall be provided and installed to extend from the fiber service loop in the main telecommunications room to the fiber service loop in each remote telecommunications room. If the route passes through a pull box, the segments of innerduct shall extend 12 inches into the pull box.
2. Within equipment rooms innerduct shall be run directly into data racks, innerduct shall face down within the data racks.
3. Innerduct shall be a minimum of 1-1/2 inches.
4. Conduit for innerduct shall be a minimum of 2 inches.
5. Installation: Fiber innerduct shall be installed in accordance with manufacturer's instructions and industry standards. Care shall be taken to avoid kinking the innerduct or applying excessive tension during the installation process

2.2 FIBER OPTIC PATCH PANELS AND CONNECTORS

A. Manufacturers:
1. Corning CCH Series
2. Siemon
3. Hubbell
4. Substitutions: Division 01 – General Requirements.

B. Fiber optic patch panels shall be capable of terminating all strands of the fiber optic cables installed in an IT equipment room.

C. Patch panels shall be rack mounted, EIA 19" wide, drawer type with integral cable management. Patch panels shall be pre-loaded with duplex SC couplings.

D. Height (in rack units) of each fiber optic patch panel shall be minimum 1U unless otherwise noted in the drawings.

E. Provide fiber optic connectors. Fiber optic modular connectors/couplings shall be NRTL listed and TIA/EIA compliant, type "SC" terminations. Connectors and couplings shall be able to withstand a minimum of 2,000 mating cycles without any transmission degradation. Maximum optical loss budget shall not exceed 0.75 dB per termination and 1.5 dB per mated pair.

F. Fiber optic connectors shall be terminated by the following methods:
1. Hot melt.
2. Heat Cured Epoxy.
3. UV Cured Epoxy.
4. Anaerobic.
5. Mechanical Splice with Index Matching Gel.

G. Fiber Optic Patch Cords:
1. Provide TIA/EIA 568B Series standard performance tested patch cables. Patch cables shall be factory pre-connectorized, two-strand, tight buffer. Patch cables connectors shall be provided by the same manufacturers as the fiber optic connectors and couplings.
2. Fiber Optic patch cables shall be with "SC" to "SC" and/or "SC" to "LC" type connectors as required. Coordinate type with Owner.

3. Quantity: (2) multimode duplex patch cords per each fiber optic pair provided for the project, plus 10% spare capacity.
4. Quantity: (2) single mode duplex patch cords per each fiber optic pair provided for the project, plus 10% spare capacity.
5. Length: All fiber optic patch cords shall be 6 feet.

2.3 COAXIAL CABLING (CATV)

A. Manufacturers:
1. Hitachi Cable America, Inc.
2. Siemon
3. Hubbell
4. Mohawk/Belden
5. Substitutions: Division 01 – General Requirements.

B. Provide coaxial RG6u cabling.

C. Terminate each cable in cable company –provided distribution equipment, located at the main demarcation point.

2.4 HORIZONTAL CABLE (CATEGORY 6A)

A. Manufacturers:
1. Hitachi Cable America, Inc. – Supra 10G UTP Category 6A
2. Siemon
3. Hubbell
4. Mohawk/Belden
5. Substitutions: Division 01 – General Requirements.

B. All cabling shall meet or exceed Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA 568-C.2, adhering to Category 6A specifications.

C. All horizontal cabling shall be communications plenum cable type (CMP).

D. Cabling shall use 23AWG minimum conductors.

E. Pulling tension: The cable pulling tension shall not exceed 25 ft/lbs as indicated in TIA/EIA-568-A.

F. Coordinate color of horizontal cabling with the Owner; **provide two (2) cables per station**.

G. Category 6A cabling shall have the following worst-case headroom losses:
1. PSNEXT Loss: +6 dB (Guaranteed Worst Case Headroom)
2. PSACRF: +6 dB (Guaranteed Worst Case Headroom)

H. Category 6A cabling shall support 10 gigabit Ethernet.

I. Category 6A cabling shall support the following Power-over-Ethernet protocols:
1. 15W PoE (IEEE 802.3af)
2. 30W PoE+ (IEEE 802.3at)
3. 60W PoE++ (IEEE 802.3bt Type 3)

J. Cable outside diameter: 0.31 inch.

K. UTP Patch Cords: Supply patch cords which meet the following specification and are of the same TIA/EIA category rating and manufacturer as the workstation cabling:
   1. EIA/TIA 568-C.2 Category 6A to match patch panel type.
   2. 23 AWG stranded conductors
   3. Quantity: (48) per each Patch Panel provided for the project, plus 10% spare capacity
   4. Length: 50% shall be 7 feet, 50% shall be 5 feet.

2.5 PATCH PANELS AND TERMINATIONS FOR HORIZONTAL CABLE

A. Manufacturers:
   1. Hubbell – Nextspeed
   2. Ortronics/Legrand
   3. Siemon
   4. Substitutions: Division 01 – General Requirements.

B. Product Description: TIA/EIA 568B rack-mounted panels.

C. Panels shall be ANGLED, 48 port, 2U, TIA/EIA 568B Cat. 6/6A type with integral printed circuit board, color coding, IDC type terminations, and 8-position jacks.
   1. Patch panels shall be either Category 6 or 6A, to match horizontal cabling type.
   2. Provide high density rack mounted patch panels.
   3. Modular port connectors that allow pre-connectorized cables to be connected to the rear of the ports are specifically prohibited. All horizontal cables shall be punched to a single point IDC-type connection on the rear of each port connector only.
   4. Each port shall have color-coded identification label.

D. Quantity: Contractor is responsible for providing quantity of patch panels required to terminate all cabling indicated on drawings at associated equipment rooms. This shall include separate patch panels for different systems where this requirement is dictated on drawings (i.e. separate patch panels for data, VOIP, wireless, building systems, and other systems indicated).

   1. Contractor shall provide quantity of patch panels required to accommodate indicated horizontal cabling with minimum 20% spare port capacity.

E. Provide horizontal wire management above and below each patch panel. Provide rear cable management bar with strain-relief brackets behind each patch panel.

2.6 WORK AREA OUTLET

A. Manufacturers:
   1. Hubbell
   2. Ortronics/Legrand
   3. Siemon
   4. Substitutions: Division 01 – General Requirements.

B. Product Description: Assembly consisting of faceplate and modular connectors that meet or exceed TIA/EIA-568B, Category 6 or 6A standard, to match horizontal cabling type.

C. Each Work Area outlet shall consist of the following:
   1. Single or double gang thermoplastic faceplate equipped with front-loading modules with the number of voice and data jacks indicated on the Drawings and Specifications.

2. Provide faceplate with clear plastic window on the top and bottom of the faceplate for labeling.
3. Faceplate Color selection by Architect.
4. Provide blank-off modules for all empty positions.
5. Provide modular jacks that meet or exceed Category 6/6A requirements for connecting hardware as specified in TIA/EIA-568B.2 standard (type as indicated on drawings). Jacks shall be front loading, 110 style, 8-pin IDC, and RJ45 type.
6. Color of each jack shall match the color of the horizontal cable. Coordinate all color requirements with the Owner and Architect.

D. Wall phone outlets shall have stainless steel recessed wallplates.

2.7 ANALOG/POTS CABLING

A. Manufacturers:
1. Hitachi Cable America, Inc.
2. Siemon
3. Hubbell
4. Mohawk/Belden
5. Substitutions: Division 01 – General Requirements.

B. All horizontal cabling shall be communications plenum cable type (CMP).

C. Analog voice cabling:
1. Backbone cabling shall be 24AWG, 25-pair cable, adhering to EIA/TIA 586-C.2 Category 5E standards.
2. Horizontal cabling shall be 24AWG, 8P8C cable, adhering to EIA/TIA 586-C.2 Category 5E standards.

D. Analog voice Patch Panels:
1. Provide 24 port minimum, 1U, Cat.5E type patch panel in each I.T. room for terminations of analog telephone horizontal cabling.
2. Provide cross connect cabling between telephone company demarcation point and analog patch panel. Terminate using Amphenol jacks, or as required by patch panel type.

E. 110-Blocks
1. Standard IDC connection type for on-premise wiring.
2. High density wall mounted cross-connect system designed for voice and data applications.
3. Included with designation labels and label holders.
4. UL Listed.
5. Provide cross connect cabling between 110-blocks and analog patch panel, where specified on plans. Terminate using Amphenol jacks, or as required by patch panel type.

2.8 RACK HARDWARE

A. Manufacturers:
1. Hubbell
2. Chatsworth
3. Tripp-Lite
4. Hoffman
5. Substitutions: Division 01 – General Requirements.

B. Equipment Racks: Free standing equipment racks shall be seven feet high, EIA 19" wide, open bay as indicated on drawings. Racks shall include the following features:
   1. 2 post supports, as indicated on drawings.
   2. Universal, 10-32 threaded hole pattern on the front and rear flanges, and mounting holes on both sides of the rack for wire management.
   3. Shelves for electronic equipment rated load carrying capacity of 125% of each piece of equipment.
   4. Mounting brackets to support equipment installed in the racks.
   5. Hook and loop Velcro cable strain-relief system on rear of rack to support horizontal and backbone cable.
   6. Hook and loop Velcro cable strain-relief system on front of rack for dressing patch cables and cross-connect wiring.
   7. Bonding and grounding cables for all equipment not directly bolted to equipment rack.
   8. Grounding bus bar with terminals for #6 copper minimum bonding cables.
   9. Provide all hardware and accessories required to properly support rack from the top and bottom and assemble rack in place.

C. Equipment Cabinets: Cabinets shall be seven feet high, 24 inches wide and 31.5 inches deep. Cabinets shall include the following features:
   1. 4 post supports.
   2. Welded construction (steel or aluminum) with full hinge doors and keyed locks (all cabinets keyed alike). Color as approved by Architect. Front door shall include vision panel, rear-door shall include louvers for ventilation.
   3. Integral EIA four (4) post equipment rack with, 10-32 threaded hole pattern for mounting of equipment.
   4. Adjustable front and rear mounting rails specifically designed to support equipment installed in the rack.
   5. Hook and loop Velcro cable strain-relief system on rear of rack to support horizontal and backbone cable.
   6. Hook and loop Velcro cable strain-relief system on front of rack for dressing patch cables and cross-connect wiring.
   7. Integral fans and louvers to adequately ventilate the equipment within the cabinets. Maintain to be no greater the 88 degrees F in warmer months.
   8. Bonding and grounding cables for all equipment not directly bolted to equipment rack.
   9. Grounding bus bar with terminals for #6 copper minimum bonding cables.
   10. Surge protected PDU, rated for 20A/120V/1P.
   11. Provide all hardware and accessories required to properly support rack from the top and bottom and assemble rack in place.

D. Wall-Mounted Cabinets: Cabinets shall be 26 inches wide and 26 inches deep. Height shall be a minimum of 18RU, or as indicated on drawings. Wall mounted cabinets shall include the following features:
   1. Capable of housing EIA-standard 19-inch rack equipment, with a maximum depth of 24.5 inches.
   2. Double-hinged construction. The user shall be able to swing the back of the cabinet outward to access equipment from behind.
   3. Load rating of at least 250 pounds.
   4. Welded construction (steel or aluminum) with full hinge doors and keyed locks (all cabinets keyed alike). Color as approved by Architect. Front door shall include vision panel, rear-door shall include louvers for ventilation.
   5. Vented side and front panels.
   6. Integral EIA four (4) post equipment rack with, 10-32 threaded hole pattern for mounting of equipment.

7. Adjustable front and rear mounting rails specifically designed to support equipment installed in the rack.
8. Hook and loop Velcro cable strain-relief system on rear of rack to support horizontal and backbone cable.
9. Hook and loop Velcro cable strain-relief system on front of rack for dressing patch cables and cross-connect wiring.
10. Bonding and grounding cables for all equipment not directly bolted to equipment rack.
11. Grounding bus bar with terminals for #6 copper minimum bonding cables.
12. Surge protected PDU, rated for 20A/120V/1P.
13. Provide all hardware and accessories required to properly support rack from the top and bottom and assemble rack in place.

E. Cable Management:
1. Provide horizontal cable management above and below each patch panel, and in locations shown on drawings. Horizontal management shall be sized no smaller than 1U.
2. Provide 6" rear cable management bar located behind each patch panel, and in locations shown on drawings.
3. Provide vertical cable management on both sides of each rack, and in locations shown on drawings. Vertical management shall be sized no smaller than 6". When mounted between racks, size no smaller than 12".

F. Overhead Ladder-Rack
1. Provide ladder-rack around perimeter of each telecommunications equipment room and in other areas indicated on plans.
2. Ladder-rack shall cross over each free-standing equipment rack.
3. Provide drop-down or "waterfall" connections from overhead ladder-rack to each equipment rack.
4. Provide all accessories for a complete system.
5. Ladder-rack shall be minimum 14" in width, unless noted otherwise on drawings.
6. All power outlets for equipment rack shall be mounted on ladder-rack.

2.9 UNINTERRUPTIBLE POWER SUPPLIES

A. Manufacturer:
   1. Tripp-Lite (basis of design)
   2. APC
   3. Eaton
   4. Substitutions: Division 01 – General Requirements.

B. Product Description:
   1. Provide uninterruptible power supplies in locations indicated on drawings. VA, voltage, and phase ratings as indicated on drawings. The below specifications apply to UPS units of various voltage/amperage combinations.

C. UPS units with 120VAC, 20A input ratings shall meet the following specifications:
   1. Tripp-Lite SMART2200RMXL2U or approved equal.
   2. Outputs:
      a. Output capacity: 2200VA / 2.2kVA / 1920W.
      b. Power factor: 0.87
      c. Frequency: 60 Hz
      d. Output voltage regulation (line mode): -14%, +6%
      e. Output voltage regulation (battery mode): -5%, +5%
      f. Output receptacles: Four(4) 5-15R; Four(4) 5-20R.
      g. Two(2) switched single outlet load banks: (1) 5-15/20R, (1) 5-15R.
      h. Output waveform (line mode): Pure sine wave
      i. Output waveform (battery mode): Pure sine wave
   3. Inputs:
      a. Rated input current: 16A
      b. Nominal input voltage: 120VAC
      c. Input connection type: 5-20P
      d. Input cord length: 10 ft.
      e. Input phase: Single
   4. Battery:
      a. Full load runtime: 4.5 min. @ 1920W
      b. Half load runtime: 12 min. @ 960W
      c. DC system voltage: 48VDC
      d. Recharge rate: Less than 4.5 hours from 10% to 90%.
      e. Battery Access: Front panel battery access door
      f. Transfer time: 5 milliseconds (line to battery mode)
   5. Input Voltage Regulation:
      a. Automatic voltage regulation (AVR) maintains line power operation with an input voltage range of 83 to 145 VAC.
      b. Voltage reduction of 12% applies when input is between 127 and 145.
      c. Voltage boost of 12% applies when input is between 96 and 108.
      d. Voltage boost of 24% applies when input is between 83 and 95.
   6. User Interface:
      a. Unit is equipped with LCD information screen.
      b. Front panel LCD information and configuration screen offers details UPS and site power status and operating data, plug configuration of voltage, operating mode, alarm function and a variety of additional options.
      c. 3 pushbutton switches control OFF/ON power status, MODE selection and MUTE/ENTER control functions.
      d. Power-fail alarm can be temporarily silenced using alarm-cancel switch; silent mode alarm configuration option available.
      e. Audible alarm indicates UPS startup, power-failure, low-battery, overload, UPS fault and remote shutdown conditions.

7. Physical:
    a. Rack- mountable in both 2 and 4 post racks.
    b. 2U rack height.
    c. Steel housing.
8. Environmental:
    a. 32 to 104º(F) operating temperature
    b. 5 to 122º(F) storage temperature
    c. 0 to 95% relative humidity; non-condensing.
    d. Heat output: 306 BTU / hr.
9. Certifications and Warranty:
    a. UL1778 certified.
    b. 2-year warranty.

D. UPS units with 120VAC, 30A input ratings shall meet the following specifications:
1. Tripp-Lite SMART3000RMXL2U or approved equal.
2. Outputs:
    a. Output capacity: 3000VA / 3.0kVA / 2880W.
    b. Power factor: 0.96
    c. Frequency: 60 Hz
    d. Output voltage regulation (line mode): -14%, +6%
    e. Output voltage regulation (battery mode): -5%, +5%
    f. Output receptacles: Eight(8) 5-15/20R; One(1) L5-30R.
    g. Output circuit breakers: Two 20A output breakers protect four 5-15/20R outlets each.
    h. Two(2) switched single outlet load banks: (2) 5-15/20R.
    i. Output waveform (line mode): Pure sine wave
    j. Output waveform (battery mode): Pure sine wave
3. Inputs:
    a. Rated input current: 24A
    b. Nominal input voltage: 120VAC
    c. Input connection type: L5-30P
    d. Input cord length: 10 ft.
    e. Input phase: Single
4. Battery:
    a. Full load runtime: 3 min. @ 2880W
    b. Half load runtime: 10 min. @ 1440W
    c. DC system voltage: 48VDC
    d. Recharge rate: Less than 5 hours from 10% to 90%.
    e. Battery Access: Front panel battery access door
    f. Transfer time: 5 milliseconds (line to battery mode)
5. Input Voltage Regulation:
    a. Automatic voltage regulation (AVR) maintain line power operation with an input voltage range of 83 to 145 VAC.
    b. Voltage reduction of 12% applies when input is between 127 and 145.
    c. Voltage boost of 12% applies when input is between 96 and 108.
    d. Voltage boost of 24% applies when input is between 83 and 95.
6. User Interface:
    a. Unit is equipped with LCD information screen.
    b. Front panel LCD information and configuration screen offers details UPS and site power status and operating data, plug configuration of voltage, operating mode, alarm function and a variety of additional options.
    c. 3 pushbutton switches control OFF/ON power status, MODE selection and MUTE/ENTER control functions.

d. Power-fail alarm can be temporarily silenced using alarm-cancel switch; silent mode alarm configuration option available.
e. Audible alarm indicates UPS startup, power-failure, low-battery, overload, UPS fault and remote shutdown conditions.

7. Physical:
   a. Rack- mountable in both 2 and 4 post racks.
   b. 2U rack height.
   c. Steel housing.
8. Environmental:
   a. 32 to 104º(F) operating temperature
   b. 5 to 122º(F) storage temperature
   c. 0 to 95% relative humidity; non-condensing.
   d. Heat output: 409 BTU / hr.
9. Certifications and Warranty:
   a. UL1778 certified.
   b. 2-year warranty.

E. UPS units with 208VAC, 30A input ratings shall meet the following specifications:
1. Tripp-Lite SMART5000XFMRXL or approved equal.
2. Outputs:
   a. Output capacity: 5000VA / 5.0kVA / 3750W.
   b. Power factor: 0.75
   c. Frequency: 60 Hz
   d. Output voltage regulation (line mode): -10%, +10%
   e. Output voltage regulation (battery mode): -5%, +5%
   f. Output receptacles: Eight(8) 5-15/20R; Two(2) L6-20R; One(1) L6-30R.
   g. Output circuit breakers: 20A double pole breaker supports L6-20R outlets, 20A branch rated breaker (x2) supports four 5-15/20R outlets each, L6-30R outlet is unbreakered.
   h. Output waveform (line mode): Sine wave
   i. Output waveform (battery mode): Pure sine wave
3. Inputs:
   a. Rated input current: 24A
   b. Nominal input voltage: 208VAC
   c. Input connection type: L6-30P
   d. Input cord length: 10 ft.
   e. Input phase: Single
4. Battery:
   a. Full load runtime: 8.5 min. @ 3750W
   b. Half load runtime: 20 min. @ 1875W
   c. DC system voltage: 48VDC
   d. Recharge rate: Less than 4 hours from 10% to 90%.
   e. Battery Access: Front panel battery access door
   f. Transfer time: 7 milliseconds (line to battery mode)
5. Input Voltage Regulation:
   a. Automatic voltage regulation (AVR) maintain line power operation with an input voltage range of 167 to 260 VAC.
   b. Voltage reduction of 12% applies when input is between 228 and 260.
   c. Voltage boost of 12% applies when input is between 167 and 194.
6. User Interface:
   a. 2 pushbutton switches control OFF/ON power status and alarm-cancel/ self-test operation.
   b. Power-fail alarm can be temporarily silenced using alarm-cancel switch; once silenced, alarm will re-sound to indicate low battery status.

c. Audible alarm indicates power failure, overload, and low battery conditions.
d. 5 LEDs indicate line power, battery power, overload, voltage regulation, and battery low/replace status.

7. Physical:
   a. Rack- mountable in both 2 and 4 post racks.
   b. 3U rack height.
   c. Steel housing.
8. Environmental:
   a. 32 to 104º(F) operating temperature
   b. 5 to 122º(F) storage temperature
   c. 0 to 95% relative humidity; non-condensing.
   d. Heat output: 671 BTU / hr.
9. Certifications and Warranty:
   a. UL1778 certified.
   b. 2-year warranty.

F. Network Management
1. All UPS's in project shall have the ability to be remotely monitored and controlled over the building network. Provide each unit with remote management card.
2. Remote management card shall be Tripp-Lite SNMP/Web Management Accessory Card or approved equal.
3. Provide power management software installed on workstation within MDF. Software shall be Tripp-Lite PowerAlert or approved equal. Workstation to be provided by others.
4. Provide a LAN connection to each UPS. Provide Cat.6 patch cord to patch panel within rack.

2.10 POWER DISTRIBUTION

A. Manufacturer:
1. Tripp-Lite (basis of design)
2. APC
3. Eaton
4. Substitutions: Division 01 – General Requirements.

B. Product Description:
1. Provide rack mounted vertical power distribution units on each rack.
2. All PDU's shall be powered via UPS at bottom of rack, unless otherwise noted.
3. Provide one (1) UPS per rack, minimum.

C. Vertical PDU:
1. All vertical power distribution units shall meet or exceed the following general requirements:
   a. 5-20P input plug. Contractor shall provide all necessary adapters to convert input plug to L5-20P if only twistlock outlets are available in UPS. Input cord shall be at least 10 feet long.
   b. 120VAC input.
   c. 2.4KW nominal load capacity.
   d. Twenty-eight(28) NEMA 5-20R outlets.
   e. 60" height.
   f. Unit shall be metered, using a Digital LED display to show the total current draw of connected equipment in amps.
   g. PDU's shall be surge protected.

2. Vertical power distribution units shall be mounted directly to each side of rack, as indicated in drawings. Provide all necessary mounting hardware.
3. Vertical power distribution units shall be Tripp-Lite model PDUMV20 or equal.

2.11 BACKBOARDS

A. Material: Class “A” fire retardant plywood.

B. Size: 3/4" thick. Width and Height as indicated on drawings.

C. **Provide backboards for all utility demarcation equipment**.

D. Paint with two(2) coats of grey paint.

2.12 SERVICE ENTRANCE TEXTILE INNERDUCT

A. Manufacturers:
1. Provide products offered by MaxCell Group/TVC Communications 600 Plum Creek Dr. Wadsworth, OH. 44281 1-888-387-3828
2. Substitutions: Division 01 – General Requirements.

B. Contractor shall provide, in at least one(1) of the building’s telecommunications service entrance conduits, flexible, textile innerduct to allow for future communication system upgrades and separation of cabling within the conduit.

C. Product Description: Standard Outdoor Textile Innerduct: Micro (33mm), 4-inch single or multi-cell polyester/nylon textile innerduct containing 1250lb polyester flat woven pull tape. Provide MaxCell 4” 3-cell or approved equal.

D. Fittings:
1. Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing one or more textile innerducts within a 4-inch inside diameter conduit, e.g.: 4-inch plug with nine holes for cables in a 3 pack (9-cell) configuration
2. Termination Bags: Inflation-type bags for sealing and securing around one or more textile innerducts and cables within 2-inch outside diameter or larger conduit.

E. Material: White Polyester and Nylon resin polymer.

2.13 LIGHTNING PROTECTION FOR COMMUNICATIONS CABLING

A. Manufacturers:
1. Circa
2. Citel
3. Times Protect
4. Substitutions: See Division 1 – Product Requirements.

B. Provide surge/lightning protection for all exterior copper telecommunications cabling (both aerial and underground). This shall include, but not be limited to the following:
1. Service entrance cabling
2. Cabling between buildings
3. Cabling for paging, clock and other building systems
4. Data/Voice horizontal cabling

5. CATV Cabling

C. Provide surge/lightning protection for all copper backbone cabling between the service entrance room to each equipment room.

D. For service entrance cabling and telecommunications backbone cabling, provide Circa model 1880ECA1-XXX or equal (sized appropriately), to interface directly with rack-mounted patch panels and distribution.

E. For horizontal data/voice cabling to exterior systems or between buildings, provide Citel model #E280 or equal, type and quantity as required by the system being protected.

F. For CATV cabling to exterior systems or between buildings, provide Citel P8AX series in-line surge arrestor or equal. Provide surge arrestor at each end of coaxial line.

G. For POE/ethernet cabling to exterior systems or between buildings, provide Citel model MJ8-POE-A or equal, type and quantity as required by the system being protected.

2.14 WIRELESS ACCESS POINTS

A. Manufacturers:
1. Netgear WAX 630 Dual Band PoE
2. Cisco
3. Linksys
4. Substitutions: See Division 1 – Product Requirements.

B. System Requirements:
1. Design and install two (2) separate wireless systems for the entire facility; one for employees, and one for public use.
2. Provide complete coverage within the building, and at all points exterior to the building.
3. Coordinate mounting of wireless access points on sports lighting poles, as required for signal strength and coverage, with GC.

PART 3 EXECUTION

3.1 INSTALLATION

A. Rated Stairs: Penetrations into stairs are NOT permitted except for items serving that stair.

B. Wiring Method:
1. Install all required telecommunications conduits, sleeves, and back boxes. Conduits, sleeves and boxes shall be installed in accordance with Section 270533.
2. Install cables in raceways, conduits and interstitial spaces above suspended ceilings.
3. Conceal wiring except in unfinished spaces.
4. Wire shall not be subjected to pulling tensions greater the maximum specified by the manufacturer
5. Wire bend radius shall not be less than the manufacturer’s minimum of one (1) inch.
6. Support cables that are not in raceway or conduit at intervals no greater than 60 inches with supports designed for high-speed twisted pair wire (“J “ hooks).

C. Backbone Cables:
   1. Install multimode and single mode fiber optic cable through the ceilings and riser conduit as indicated on the attached cable plates. The fiber shall be run in innerduct for its entire length. Cables shall be terminated as follows:
   2. Multi/Single Mode Fiber: Mount SC type terminators in a 19" rack mounted enclosure at both ends.

D. Horizontal Cables:
   1. Mount new station jacks on the specified plate, flush or surface mounted, as construction requires.
   2. At the station end, terminate 4-pair UTP cables on 8-pin modular jacks according to TIA/EIA 568B terminating specifications.
   3. At the telecom room, terminate all 4-pair UTP cables (voice & data) onto panel mounted 8-pin modular connectors that meet the TIA/EIA 568B specification. Provide sufficient patch jacks (ports) at each telecom closet to terminate the cables from all of the stations served by that closet. Mark the voice and data patch terminating jacks with its associated station identification in ascending sequential order. Mark patch panel using the Panduit system or equal. Match the patch panels into the supplied equipment racks.
   4. Analog Line (Emergency Line) Connection:
      a. Coordinate with Telephone provider. Telephone provider shall terminate phone service at DEMARC. Contractor shall extend, punch down and make final connections to the specific locations listed below for complete service.
      b. Provide patch panels as indicated in above PART 2. Terminate all cables within these panels.
      c. The Contractor is responsible for establishing an analog metallic connection to each analog line, locations shown on drawings.
   5. Provide coaxial cabling from work stations back to cable company demarcation equipment.
   6. Provide 9” of slack on outlet boxes behind each faceplate.

E. Supports:
   1. Cabling shall be supported via cable trays where indicated in drawings. Cabling between cable tray and work station shall be supported via J-Hooks as indicated in drawings. Where cable tray is not indicated on drawings, cabling shall be supported via J-Hooks along entire run from telecom room to work area outlet.
   2. Refer to Section 270529 – Hangers and Supports for Communications Systems for J-hook product and installation requirements.

F. Grounding of telecommunications equipment and cabling:

   1. Ground all equipment in accordance with Section 260526 – Grounding and Bonding.

   2. Provide grounding, surge protection and lightning protection of telecommunications system in accordance with latest version of Grounding, Bonding and Electrical Protection chapter of the BICSI TDM Manual, TIA/EIA 607, and NFPA 70.

   3. Conform to all telecommunications grounding and bonding details and riser diagrams included within the drawings.

G. Wall phone boxes shall be spaced 10” away from any sidewall, corner, doorjamb or adjacent box.

3.2 TESTING, HORIZONTAL CABLING

A. Horizontal cabling testing shall be conducted from the jack at the outlet in the Work Area to the Patch Panel on which the cables are terminated.

B. Baseline accuracy of the test equipment must exceed TIA Level III, as indicated by independent laboratory testing. Test adapter cable must be approved by the manufacturer of the test equipment.

C. All horizontal cables must be tested with a Level 3 Fluke DTX Networks Cable Tester.

D. Testing of the Permanent Link shall be performed. However, contractor shall warrant performance based on channel performance and provide patch cords that meet channel performance criteria. All cabling not tested strictly in accordance with these procedures shall be retested at no cost to the Owner.

E. Horizontal station cables shall be free of shorts within the pairs, and be verified for continuity, pair validity, and polarity, and Wire Map (Conductor Position on the Modular Jack). Any defective, split or miss-positioned pairs must be identified and corrected.

F. Testing of the Cabling Systems rated at TIA Category 6/6A and above shall be performed to confirm proper functioning and performance.

G. Testing of the Transmission Performance of station cables (Category 6/6A) shall include:
1. Length
2. Attenuation
3. Pair to Pair NEXT
4. ACR
5. PSNEXT Loss
6. Return Loss
7. Pair to Pair ELFEXT Loss (Equal Level Far End Cross-Talk)
8. PSEFEXT Loss
9. Propagation Delay
10. Delay Skew
11. Return Loss

H. The maximum length of horizontal cable shall not exceed 90 meters, which allows 10 meters for equipment and patch cables.

I. Cables shall be tested to the maximum frequency defined by the EIA/TIA 568B standards covering that performance category. Test records shall verify a “PASS” on each cable and display the specified parameters – comparing test values with standards based “templates” integral to the unit.

J. Any “Pass*” or “Warning” test results shall be considered a “FAIL” for the channel or permanent link under test. In order to achieve an overall “Pass Condition”, the test result for each individual test parameter shall be “PASS”.

K. All data shall indicate the worst-case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1MHz to the highest relevant frequency, using a swept frequency interval consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations. And in both directions when required by the appropriate standards.

3.3 TESTING, FIBER OPTIC CABLING

A. Tests after Installation
   1. Upon completion of a cable installation and termination, the Fiber Optic cabling shall be tested to include Optical Attenuation ("Insertion Loss" Method).

B. Optical Attenuation Testing
   1. Optical Attenuation shall be measured on all terminated optical fibers, in both directions of transmission, using the "Insertion Loss" method. Measurement shall be inclusive of the optical connectors and couplings installed at the system endpoints. Access jumpers shall be used at both transmit and receive ends to ensure an accurate measurement of connector losses.
   2. Field test instruments for fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50-B.3, Method A. This launch condition shall be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-B.1) with Category 1 light source.
   3. Field test instruments for single mode fiber cabling shall meet the requirements of ANSI/EIA/TIA-526-7.
   4. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
   5. The fiber optic launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.
   6. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests detailed in the following section.
      a. Performance Test Parameters
         1) The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA standard 568-B.1
         2) Link Attenuation = Cable_Attn + Connector_Attn + Splice_Attn
         3) Cable Attn (dB) = Attenuation Coefficient (dB/km) * Length (Km)
         4) The values for Attenuation_Coefficient are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation_Coefficient (dB/Km)
Single-mode outside plant	1310	0.5
	1550	0.5
Single-mode inside plant	1310	1.0
	1550	1.0

5) Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)
6) Maximum allowable mated connector_loss = 0.70 DB
7) Splice_Attn (dB) = number of splices (S) * splice_loss (dB)
8) Maximum allowable splice_loss = 0.2dB
9) Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters , or optical amplifiers.
10) Test equipment shall measure the link lenth and automatically calculates the link loss based on the above formulas is preferred.
11) The above link test limits attenuation are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.
12) The backbone link shall be tested in two directions at both operating wavelengths to account for attenuation deltas associated with wavelength.
13) Backbone links shall be tested in accordance with ANSI/EIA/TIA-526-14A.
14) Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation shall be used to determine limit (acceptance) values.
15) Single mode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7. All single mode links shall be certified with test tools using laser light sources.

3.4 DOCUMENTATION

A. At the completion of the project and prior to system acceptance provide the following documentation:
   1. As-built floor plans that show the final location and identification of the telecom outlets. Submit the floor plans in printed form and as AutoCAD 2010 files (Original AutoCAD files will be made available).
   2. Test results for each strand of fiber optic cable installed. This should be supplied in a page per strand printed format and in machine-readable (computer file) format. If the machine-readable file requires special software for reading, a single-user version of that software shall be provided as well.
   3. Test results for each pair of copper riser cabling installed and the installed cable length.
   4. Test results for each UTP station cable installed. This should be supplied in a page per cable printed format and in machine-readable (computer file) format. If the machine-readable file requires special software for reading, a single-user version of that software will be provided as well.

5. Test results for each coaxial riser and horizontal cable installed. Documentation indicating successful testing and length for each cable shall be bound and provided by the vendor.
6. Cross connection documentation for the voice station cable (cut sheets) which detail the station number, telecom room, and riser pair number for each installed cross connection.

END OF SECTION

SECTION 274100 - AUDIO-VIDEO SYSTEMS

PART 1 GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections with DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

B. Attention is directed Section 26 0400 – GENERAL CONDITIONS FOR ELECTRICAL TRADES, which is hereby made a part of this Section of the Specification

1.2 SUMMARY

A. Section Includes:
1. Audiovisual Cabling for in-wall applications.
2. Audiovisual patch cords.
3. Audiovisual connectors.
4. Extenders and HDBASE-T equipment.
5. Digital signage, including monitors and media players.

B. Related Sections:
1. Division 01 – General Requirements
2. Section 26 0400 – General Conditions for Electrical Trades.
3. Section 27 0529 – Hangers and Supports for Communications Systems.
4. Section 27 0533 – Raceway and Boxes for Communications Systems.
5. Section 27 0553 – Identification for Communications Systems.
6. Section 27 4120 – Speech-Reinforcement systems (for interconnection with sound systems).
7. Section 27 4117 – Specialized Sound systems (for interconnection with sound systems).
8. Section 27 1000 – Structured Cabling (for Ethernet cable requirements).

1.3 REFERENCES

A. All wire and components supplied shall meet the requirements of the following and all sub-referenced documents:
1. The National Electrical Code, Article 800.
2. Underwriters Laboratories (UL).
3. EIA/TIA 568-B.

1.4 SYSTEM DESCRIPTION

A. This Specification establishes the requirements necessary to achieve the intended performance and function of the Audio-Video System(s) described herein. Therefore, all materials and labor that are specified are necessary to meet these requirements. It includes materials and labor required to provide a complete and operable system(s) as specified herein and shown with the Audio-Video Systems drawings.

B. It is understood and agreed by the project contractor that the systems described herein shall be completed in every detail necessary to supply a complete, working system(s) implemented in a professional manner.

C. This text as well as the provided drawings are only necessary to define the design intent and anticipated performance requirements. Equipment not discreetly mentioned or outlined in these documents shall be provided without claim for additional payment.

D. Drawings included with this document shall be considered part of this specification. The Contractor will provide complete and operating system(s) including all labor and materials for all assemblies and sub-assemblies either specified or implied within this project document.
   1. Equipment function and features are to be provided by the Contractor. Where a specific item is listed by manufacturer's name and product number it identifies a minimum requirement for performance parameters and functionally defined by the product. This is not only limited to the device specified but also by the manufacturer's warranties.
   2. If a Contractor intends to provide goods other than those specified, such as "an equivalent" device it must clearly be documented within the bid response. Proposed "equivalent" items must include a written certification from the manufacturer of the replaced item stating the equivalency of each item in regard to features, function, performance, and future system capabilities.
   3. A contractor wishing to substitute items with an equivalent product must be willing to demonstrate the equivalency of said item to the owner and owner's representative at the contractor's expense. This proof of equivalency, in addition to the manufacturer's letter may include the following.
      a. "On-Site" side by side demonstration of both the specified unit and the proposed equivalent item.
      b. Independent laboratory test report. This is to include spreadsheet comparison of all critical distortion, frequency response, dynamic range, and power requirements. All tests based upon current AES standards.
      c. Equipment costs for proposed substitution items shall be listed showing the owner or owner's representative a cost savings incurred with the use of said proposed item.
      d. Contactor costs incurred, travel expenses, and other related costs shall be incurred by the contractor.
      e. Any professional services, service fees of engineers, consultants, or architects as a result of time being expended during this review, charged to the owner ,shall be reimbursed to the owner by the contractor and/or his sub-contractor.

E. Provide all audiovisual patch cables to establish complete systems to the end-user level.

F. The audiovisual cable raceway systems consist of the following:
   1. The Metallic Conduit System is a network of empty conduits into which the Audiovisual Contractor shall install the cables for the audiovisual system.

G. Unless specifically called out otherwise, all audiovisual system wiring listed in the audiovisual schedule of terminations shall be run in metallic conduit.

1.5 SUBMITTALS:

A. Submit under provisions of Division 01.

B. Submittals shall include a complete "Bill of Material" by each sound system area. This shall include all components required to complete an operational system. Each item shall include the following:
   1. Quantity of device(s)
   2. Manufacturer's current model number
   3. Manufacturer's name
   4. Item description

C. CAD produced drawings shall be included with package. These shall include, but not be limited to, the following:
   1. All systems showing general wiring.
   2. All System(s) signal path, as a one line riser.
   3. Any and all custom manufactured panel assemblies.
   4. Equipment Cabinet Risers

D. List a minimum of four completed project references similar to the scope of this project. Include project name, location, and contact names of references.

E. Provide a statement from the major manufactures showing the audio-video contractor is an authorized representative of that product. This is to insure products are current, recall notices are acknowledged, and correct programming/installation methods are employed as recommended by the manufacture.

F. Include a list of testing equipment owned by the Audio-Video contractor.

G. Warranty Information: The vendor is required to submit specifications describing the standard warranty for all proposed cable and hardware.

H. Submit a conduit riser diagram for all audiovisual system wiring.

1.6 CLOSEOUT SUBMITTALS

A. Division 01– General Requirements.

B. Project Record Documents: Record actual locations of all input and output stations for display devices.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum THREE YEARS documented experience.

B. Installer: Company specializing in installing products specified in this section with minimum three years documented experience.

C. Provide a full time, on-site Project manager to supervise the project.

D. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

E. Pre-approved audiovisual integrators/installers are as follows:
   1. DSI Tech
   2. HDT Global
   3. Paragon Sight and Sound

1.8 PRE-INSTALLATION MEETINGS

A. A minimum of one contractor meeting will be required with the owner or owner's representative to review the scope of project. The intent of this is to review submittals, proposed construction, proposed installation, and to coordinate sound system(s) installation with other trades.

1.9 EXTRA MATERIALS

A. Provide TWENTY(20) of each patch cable type.

B. Provide TWENTY(20) of each audiovisual connector type (HDMI, USB, 3.5mm, etc.)

C. Provide FIVE(5) of each extender (five of each component of system).

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and product in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.11 COORDINATION

A. Coordinate the installation of cable and equipment with other construction activities and the work of other sections.

1.12 WARRANTY

A. Contractor's Warranty: Warranty the installation to be free of defect for a period of two (2) years.

B. Equipment Warranty: Each piece of equipment shall carry a two(2) year manufacturer's warranty.

1.13 MOCKUP

A. Provide a complete Classroom mock-up (one typical classroom) for coordination and review by owner and engineer prior to installing systems throughout the building. Refer to Division 01 – Quality Requirements and Section 26 0400 – General Conditions for Electrical Trades.

PART 2 PRODUCTS

2.1 AUDIOVISUAL CABLING

A. Manufacturers:
1. C2G
2. Extron
3. FSR
4. Belden
5. Crestron

B. Passive HDMI cable for in-wall applications:
1. Basis of Design model numbers:
a. Legrand/C2G 50612: 15 ft High Speed HDMI Cable.
2. Provide this system where indicated on the drawings, and where HDMI in-wall cabling is 15 feet or less in length.
3. Passive HDMI cables shall not require power for transmission and shall support the specification listed herein without a power supply.
4. Passive HDMI cables shall be provided with a compatible pass-through HDMI 2.0 connector/keystone mounted in a faceplate on both the source and display ends of the run. The connector shall be by the same manufacturer as the cable and shall be approved by the cable manufacturer to support the specifications listed herein, with minimal signal degradation.

5. Active HDMI cables shall meet or exceed the following specifications:
   a. CL2-rated jacket for in-wall installations.
   b. Supports resolutions up to 4096x2160 at 60 Hz 4:4:4 (Full 4K), including 3D and dual video streams (Dual View).
   c. Data speeds up to 18.0Gbps.
   d. Supports full HD Blu-ray and HD DVD video.
   e. Supports 8, 10, 12, and 16 bit per channel deep color.
   f. Supports up to 32 audio channels and a 1536kHz audio sampling rate.
   g. Supports DTS-HD Master Audio™, Dolby TrueHD™, DTS, Dolby AC3 & DSD Audio.
   h. Supports extended CEC (Consumer Electronics Control) commands and functions, HDMI Ethernet Channel (100 Mbits/s) and ARC (Audio Return Channel).
   i. Type “A” male HDMI pre-terminated connectors on both ends.

C. Active/powered HDMI cable for in-wall applications:
   1. Basis of Design model numbers:
      a. Legrand C2G 41413: 25 ft Active High Speed HDMI Cable.
      b. Legrand C2G 41414: 35 ft Active High Speed HDMI Cable.
   2. Provide this system where indicated on the drawings, and where HDMI in-wall cabling exceeds 15 feet in length.
   3. Active HDMI cables shall not require any external power connectors or dongles.
   4. Active HDMI cables shall receive power by plugging directly into the source and display devices. Do not provide keystones, female connectors or patch cords for connectivity. Provide rubber grommet pass through devices within faceplates on both the source and display end for direct routing of HDMI cable.
   5. Active HDMI cables shall meet or exceed the following specifications:
      a. CL3-rated jacket for in-wall installations.
      b. Supports resolutions up to 4096x2160 at 60 Hz 4:4:4 (Full 4K), including 3D and dual video streams (Dual View).
      c. Data speeds up to 18.0Gbps.
      d. Supports full HD Blu-ray and HD DVD video.
      e. Supports 8, 10, 12, and 16 bit per channel deep color.
      f. Supports up to 32 audio channels and a 1536kHz audio sampling rate.
      g. Supports DTS-HD Master Audio™, Dolby TrueHD™, DTS, Dolby AC3 & DSD Audio.
      h. Supports extended CEC (Consumer Electronics Control) commands and functions, HDMI Ethernet Channel (100 Mbits/s) and ARC (Audio Return Channel).
      i. Type “A” male HDMI pre-terminated connectors on both ends.

D. USB cables shall meet or exceed the following specifications:
   1. Version “3.0”.
   2. A-A or A-B type, as indicated on drawings.
   3. 24 / 28 AWG copper conductors.
   4. Up to 4.8 Gbps bandwidth.

E. Stereo audio cables shall meet or exceed the following specifications:
   1. 3.5mm type
   2. Shielded
   3. Tip-ring-sleeve
   4. Fully molded connector with strain relief

F. VGA cables shall meet or exceed the following specifications:
   1. Supports up to 2048x1536 resolution.
   2. 15-pin type.

3. 26 / 28 AWG copper conductors.
4. Voltage Rating: 30V.
5. Nominal Impedance: 75 ohm, +/- 5 ohm.

G. All cables shall be factory-supplied with connectors as indicated on drawings.

H. All cables shall be rated for in-wall applications.

2.2 AUDIOVISUAL CONNECTORS

A. Connectors from the following manufacturers shall be considered acceptable. Install connectors appropriate for the installed cable and equipment interface. Use appropriate tooling as specified by the connector manufacture to install the connectors.
1. Hubbell
2. Tripp-Lite
3. Extron
4. FSR

B. HDMI connectors:
1. Description: HDMI 2.0 feed-through keystone.
2. Approved and recommended for use with the associated HDMI cable (passive or active), as noted in above paragraph.

C. VGA connectors:
1. Description: 15-pin screw terminal, suitable VGA, SVGA, XGA and SXGA resolution.

D. USB connectors:
1. Description: USB 3.0 A-A feed through keystone.

E. Stereo audio (3.5mm) connectors:
1. Description: 3.5mm screw terminal.

F. Provide all necessary mounting accessories, faceplates and keystones for a complete installation.

G. Blank spaces in audiovisual faceplates shall be filled with blank connector components, Hubbell iStation SFB10 or equal.

2.3 EXTENDERS AND HDBASE-T EQUIPMENT

A. Manufacturers:
1. Crestron
2. Hubbell
3. Extron

B. System description: Audio-video equipment for the purpose of extending multiple signals over a single Cat.X cable.

C. Refer to drawings for model numbers and additional product requirements.

D. At a minimum, all extenders shall meet the following general specifications:
1. Support 4K and 1080p video signal.
2. Support USB 3.0 capability.
3. Support stereo audio signal.

E. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees. Said modifications shall include, but not be limited to, changes to 120VAC power outlets, conduits, backboxes, data cabling, infrastructure and other required pathways.

2.4 DIGITAL SIGNAGE

A. Manufacturer:
1. Basis of Design: Carousel.
2. Approved Equals: Advantech, Mitsubishi.
3. Substitutions: See Division 01 – General Requirements.

B. Product Description: Provide wall mounted digital signage screens with HDMI-over-Ethernet media players and a programmable software suite for display of current events and other multimedia.

C. Digital Signage Platform shall be Carousel Player Software or equivalent. System shall include programmable schedule that automatically powers a monitor on or off at set days and times. Contractor is responsible of setting up configuration software at a central computer and linking screens to form a unified content management system for all the digital screens in the building.

D. Digital Signage Screens shall be Samsung DC49J or equivalent. Screen meet or exceed the following specifications:
1. 49” diagonal.
2. Edge-lit display.
3. 1920x1080 resolution, 16:9 aspect ratio.
4. Built-in tuner.
5. HDMI input.
6. 3000:1 contrast ratio.
7. Plug and play capability.

E. Media Player shall be BrightSign model HD223 or equivalent. Device shall meet or exceed the following specifications:
1. Single 1080p60 video decoding
2. Video Codecs: H.265, H.264(MPEG-4, Part 10), MPEG-2, MPEG-1
3. Display resolutions: 1920x1080x24/25/29.92/30/50/59.94/60p, 1920x1080x50/59.94/60i, 1600x1200x60p, 1440x1050x60/75p, 1440x900x60/75p, 1360x768x60p, 1280x1024x60/75p, 1280x960x60p, 1280x800x60p/75p, 1280x768x60p, 1280x720x50/59.94/60p, 1024x768x60p, 800x600x60/75p, 720x576x50p/50i, 720x480x59.94/60p/60i, 640x480x60p
4. Ethernet connectivity.
5. HDMI 2.0a Out
6. External micro SD Slot (SDHC and SDXC); SDHC storage up to 32GB SDXC storage up to 2TB.

2.5 OTHER DISPLAY EQUIPMENT

PART 3 EXECUTION

3.1 INSTALLATION – GENERAL

A. Prior to installation, the Electrical Contractor shall submit a riser diagram for all audiovisual system conduit.

B. No installation work shall proceed until the conduit riser has been approved, in writing, by the Electrical Engineer.

C. All lines installed in conduits shall be splice free. Cabling shall be free from installation damage.

D. All connector wiring shall be by rosin core solder joints. No push on type connectors shall be accepted.

E. All cables to be numbered and identified in "As Built Documents". Provide permanent cable identification.

F. Project shall be adequately staffed at all times. Coordination with other trades and cooperation is mandatory.

3.2 INSTALLATION – EQUIPMENT

A. All material and equipment to be new and unused.

B. Provide adequate ventilation for all active electronic equipment.

C. All equipment shall be installed without dents, scratches, free of marks and blemishes.

D. The contractor is responsible for all tuning, programming, setup and configuration of all audiovisual systems.

E. Monitors/Screens: Supply screens with tilting wall mounts or single point ceiling mounts with provision for mounting a Set Top Box If connected to the Digital Streaming Media system. Mount the units at the locations indicated on the Technology Drawings. Connect the units to AC power and the Local Area Network or CATV distribution as required. Confirm full operation.

3.3 INSTALLATION - WIRE GROUPS IN CONDUIT

A. All audiovisual wiring shall be installed in conduit.

B. Minimum conduit diameters and diagrammatic routing of audiovisual conduits are indicated on drawings.

C. The actual diameter and path of each conduit run shall be determined by the Electrical Contractor in accordance with field conditions.

D. Should the Electrical Contractor choose to combine cable runs from individual terminations into a common conduit, then they must conform to the wire grouping, conduit fill, and conduit separation requirements listed in this Section.

E. To prepare the required conduit riser diagram, the Electrical Contractor must group cables by wiring type; determine the total number of cables in each conduit run; determine the diameter of each conduit run; determine the actual routing of each conduit run.

F. Refer to Paragraph 3.4 of this Section for wiring group and conduit separation requirements.

G. Refer to Table 5 at the end of this Section for audiovisual cable specifications and conduit capacities.

3.4 INSTALLATION - CONDUIT SEPARATION

A. Audiovisual system wiring is divided into separate groups according to their nominal voltage levels. These wiring groups must never be intermixed within a given conduit run. See Table 2 at the end of this Section for wire type information.

B. Conduits carrying audiovisual wiring must maintain a minimum separation from conduits carrying other types of audiovisual wiring. When necessary, ninety degree crossings in close proximity are acceptable. See Table 3 at the end of this Section for audiovisual conduit separation requirements.

C. Conduits carrying audiovisual wiring must maintain a minimum separation from conduits carrying other types of electrical wiring. Unusually heavy current demands in; or long parallel runs with; electrical services may dictate greater separations to avoid interference with the audiovisual system. See Table 4 at the end of this Section for electrical conduit separation requirements.

3.5 INSTALLATION - METALLIC CONDUIT SYSTEM

A. The metallic conduit system is specified by information called out in the large-format audiovisual system drawings:
   1. The location drawings indicate the position of each audiovisual device and the method of mounting each device.
      a. The schedule of terminations lists each audiovisual device; indicates the quantities, types, and groupings of all cables connected to each device; and lists the destination for all cables exiting each device.

B. Refer to Table 5 at the end of this Section for audio cable specifications and conduit sizing requirements.

C. In most cases, each run of this conduit system shall be bonded to the audio termination back boxes which are provided by the Audiovisual Contractor. The only exception is conduit which is routed to the audio equipment racks. Conduit runs entering or exiting the audio equipment racks shall be electrically isolated from the racks. PVC or other non-conductive fittings shall be used to isolate the conduit from the audiovisual equipment racks.

D. Provide all empty conduits with pull lines.

3.6 INSTALLATION - CABLE SLEEVES

A. Install per architectural detail drawings with threaded cap at each end of sleeve. These caps shall be lubricated for easy removal and held captive by a chain.

3.7 TESTING

A. Each cable and equipment manufacturer shall factory-test their respective products being installed on this project and provide test reports at time of delivery. Provide separate, respective test reports, indicating that products meet or exceed the latest applicable TIA/EIA Standards and technical bulletins.

B. All other products relative to this specification shall be tested to their respective industry’s strictest standards.

C. Each manufacturer shall factory-test their respective cable or equipment provided to this project at several lower frequency levels, including the minimum and maximum frequency level indicated herein. The test reports shall indicate test results for at least five equal incremental frequency levels, including the maximum required.

D. Presentation Systems: Verify the functionality of each installed system. Verify that connectors are properly installed and where appropriate, screwed down. Cable shall be neatly dressed and tied back. Tag cable with permanent markers indicating the function of each cable. Adjust and balance audio systems to provide a minimum of 85db/spl at the average listening position. System testing shall be coordinated with the Owner's representative.

3.8 DOCUMENTATION

A. Provide copies of all manuals and two (2) sets of as-built documents, in hard copy and electronic format. As-built documentation shall include location and types of hardware provided and installed as well as the interconnection of each device.

3.9 TRAINING:

A. The Owner may assign personnel to participate with the contractor during installation. Without delaying the work, familiarize the Owner's personnel with the installation, equipment, and maintenance.

B. Provide training to personnel selected by the Owner on operation and basic maintenance of all systems and equipment.

C. Include 8 hours of training Owner's staff.

3.10 REFERENCE TABLES

TABLE 1 - PROJECT WORK SCOPE

ITEMS TO BE PROVIDED AND INSTALLED	Electrical Contractor		Audiovisual Contractor	
	Provides	Installs	Provides	Installs
Audiovisual Equipment Racks and Devices			x	x
1.Metallic Conduit between Audiovisual Devices and Audiovisual Equipment Racks	x	x◊		
2. Conduit Insulation Bushings between Metallic Conduit and Audiovisual Equipment Racks	x	x◊		
3. Audiovisual Equipment Rack Cabling			x	x
4. Audiovisual Equipment Rack Terminations				x
5. Audiovisual Device Back Boxes and Floor Boxes		x◊	x	
6. Audiovisual Device Metallic Conduit	x	x◊		
7. Audiovisual Device Cabling			x	x
8. Audiovisual Device Termination				x
Audiovisual Cable Sleeves	x	x		
Audiovisual Pull Boxes	x	x		
Conduit Riser Diagram	x			

◊ Installation criteria to be provided by Audiovisual Contractor

TABLE 2 - AUDIOVISUAL WIRING TYPES

Audiovisual system wiring is divided into wiring groups according to their nominal voltage levels:

	Wiring Type
Group A	Microphones and other sensitive wiring (0 mV to 100 mV)
Group B	Line level wiring (100 mV to 10 V)
Group C	Loudspeaker and control wiring (10 V to 70 V)
Group D	Telephone, video, control and digital circuits (including Category Structured cabling for data)
Group E	Fiber optic cable

Note: These wiring groups must never be intermixed within a given conduit run!

TABLE 3 - AUDIO CONDUIT SEPARATION
Minimum conduit separation between conduits carrying wiring of different audiovisual groups is as follows:

	Group A	Group B	Group C	Group D	Group E
Group A	adjacent	6"	12"	12"	adjacent
Group B	-	adjacent	12"	6"	adjacent
Group C	-	-	adjacent	6"	adjacent
Group D	-	-	-	adjacent	adjacent
Group E	-	-	-	-	adjacent

Note: Ninety degree crossings in close proximity are acceptable.

TABLE 4 - ELECTRICAL CONDUIT SEPARATION
Minimum conduit separation between conduits carrying audiovisual wiring and other electrical service conduit is as follows:

	Group A	Group B	Group C	Group D	Group E
Dimmer controlled lighting	24"	12"	6"	12"	adjacent
SCR controlled services	24"	12"	6"	12"	adjacent
220/440VAC circuits	6"	6"	adjacent	adjacent	adjacent
All other services	6"	6"	adjacent	adjacent	adjacent

Note: Heavy current demands in or long parallel runs with the above services may dictate greater separations to avoid interference with the audiovisual systems.

TABLE 5 - CONDUIT SIZING FOR AUDIO CABLES

Audio Cable (dimensions in inches)				Maximum number of audio cables allowed in each conduit size (Based on 40% fill of EMT)						
Mfr	Type	OD	Area	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"
Belden	1351A	0.290	0.066	3	5	9	12	20	35	53
Belden	1502R	0.250	0.049	4	7	12	17	27	48	72

Belden	1694A	0.274	0.059	4	6	10	14	23	40	60
Belden	1696A	0.234	0.043	5	8	14	19	31	54	82
Belden	1700A	0.200	0.031	7	11	19	26	43	75	113
Belden	2412	0.220	0.038	5	9	15	21	35	61	93
Belden	7710A	0.770	0.466	0	1	1	2	3	5	8
Belden	7712A	0.970	0.739	0	0	1	1	2	3	5
Belden	7810A	0.405	0.129	2	3	5	6	10	18	27
Belden	8240	0.193	0.029	7	12	20	28	46	80	121
Belden	8281	0.305	0.073	3	5	8	11	18	32	48
Belden	8444	0.185	0.027	8	13	22	30	50	87	132
Belden	8451	0.138	0.015	14	23	40	54	90	157	237
Belden	8465	0.282	0.062	3	6	10	13	21	38	57
Belden	8467	0.314	0.077	3	4	8	11	17	30	46
Belden	8471	0.274	0.059	4	6	10	14	23	40	60
Belden	8473	0.340	0.091	2	4	7	9	15	26	39
Belden	8477	0.386	0.117	2	3	5	7	11	20	30
Belden	8489	0.257	0.052	4	7	12	16	26	45	68
Belden	8620	0.376	0.111	2	3	5	7	12	21	32
Belden	8734	0.194	0.030	7	12	20	28	45	79	120
Belden	8760	0.222	0.039	6	9	15	21	35	61	91
Belden	9451	0.135	0.014	15	24	42	57	94	164	247
Belden	9460	0.230	0.042	5	8	14	20	32	56	85
Belden	9831	0.330	0.086	2	4	7	9	15	27	41
Belden	9844	0.390	0.119	2	3	5	7	11	20	30
Belden	9941	0.230	0.042	5	8	14	20	32	56	85
Crestron	DM-CBL-NP	0.580	0.264	0	1	2	3	4	8	13
Crestron	DM-CBL-8G-NP	0.244	0.047	4	7	12	17	28	50	75
Trade	#08 THHN	0.216	0.037	6	9	16	22	37	64	97
Trade	#10 THHN	0.164	0.021	10	16	28	39	64	111	168
Trade	#12 THHN	0.130	0.013	16	26	45	61	101	177	267
Trade	#14 THHN	0.111	0.010	22	36	62	84	139	242	366

Note: Minimum conduit size allowed for audio cables is 3/4 inch.

END OF SECTION

AV BASIS OF DESIGN - MATERIAL DESCRIPTION

Qty	Model	Description
	Reception - Room 100A	
	AV Systems	
1	BE65D-H	65" 4K Business Pro TV, Crystal UHD Processor
1	KITMTM1PC1	Fusion Medium Tilt Wall Mount Kit with MTM1U, PACPC1 and FCA110, Black
1	LS425	H.265, Full HD, HTML5, graphics & digital audio, ideal for looping video
1	Custom	Misc Field Cables & Materials
1	Custom	Misc Field Installation Materials
	Gymnasium - Room 101	
	AV Systems	
1	SP840A	15" Full Coverage 360 x 180 Speaker
2	OS2X12	Dual 12" Bipole Subwoofer
2	SPH2L-SS-10	Mounting Assembly
2	OS2X12-BS	Bracket system
1	RABX2	Bluetooth and Auxiliary Input Remote Audio Mixer
1	PS-RABX2	Power Supply for RABX2
1	RAMX2	Microphone and Auxiliary Remote Audio Mixer
1	SMLV-2-LD	Surface / Table Flush Mount Low Voltage Dual Gang Vandal Proof Enclosure - Locking
1	FA-2	Single gang flange adapter to convert to flush mount configuration.
1	55SH Series II	Iconic Unidyne Vocal Microphone
1	DS7E	Adjustable Height Desktop Microphone Stand - Black
1	MXWNDX4	Networked Charging Station
1	MXWAPX4=-Z10	Access Point Transceiver
2	MXW2X/BETA58=-Z10	Handheld Transmitter with Beta58A Capsule
2	MXW1X/O=-Z10	Hybrid Bodypack Transmitter
2	WL185MB/C-TQG	Low-profile Cardioid Lavalier Microphone (TA4F)
2	Axon D2i	Dante™/AES67 network audio interface (Attero Tech)
1	Core 8 Flex	Q-SYS network + analog I/O processor
1	SLDAN-16-P	Software-Based Dante License, 16-Channel, Perpetual
1	CX-Q 2K4	Q-SYS Four-channel Network Amplifier
1	NS10-125+	PoE+ NS Series Gen 2 Network Switches
2	TSC-70-G3	7" Projected capacitive Touch Surface
2	371790-1	BB-2125 Single-sided LED basketball scoreboard - 10"/7" LED - 4'x10'x6' - w/controller
1	SR-40-28	SR Series Large Pivoting Rack - 40RU
1	LVFD-40	40 RU Vented Front Door for SR - 64% Open
1	UPX-RLNK-OL2000R-2	2000VA, 20 Amp Online UPS Backup Power System with RackLink, Bank Outlet Control
1	BL4	4 RU Flanged Blank Rack Panel, Black Brushed and Anodized Aluminum
12	BL2	2 RU Flanged Blank Rack Panel, Black Brushed and Anodized Aluminum
12	BL1	1 RU Flanged Blank Rack Panel, Black Brushed and Anodized Aluminum
1	U1	1U Utility Rack Mounted Shelf, 10.8" Depth, Solid Rack Shelf
1	U2	2 RU Utility Rackshelf, 14.75 Inches Deep
1	D3	Middle Atlantic D3 Heavy-Duty Rack Mounted Drawer, 3U
1	PDX-915R-SP	NEXSYS 9 Outlet, 15 Amp Rackmount Power with Series Surge Protection
1	2E706	Universal Guard: Snap-On, Clear, Ring Base/Solid Base - 8" x 5" - Locking
3	2E379	Universal Guard: Snap-On, Clear, Ring Base/Solid Base - 6" x 4" - Locking
1	Custom	Misc Field Cables & Materials
1	Custom	Misc Field Installation Materials
	AV Systems	
2	BE75D-H	BED-H Series 75" 4K Business TV
2	LTM1U	Large Fusion Micro-Adjustable Tilt Wall Mount
2	CSMP9X12	Proximity Component Storage Panel, Interface
4	WPD-HD-U3C-AW	HDMI and USB-C 3.0 Pass-Through Single Gang Decorative Wall Plate with Pigtail - White
2	AC-BT03-AUHD	3m 4K 18Gbps High Speed HDMI Cable
2	AC-BT02-AUHD	2m 4K 18Gbps High Speed HDMI Cable
2	BT-USBC-03	3m 4K USB 3.2 Gen 2 Type-C to Type-C Cables
2	BT-USB-A2C-02	2m USB 3.2 Gen 2 Type-A to Type-C cables

Qty	Model	Description
1	Custom	Misc Field Installation Materials
	Teen Room - Room 115	
	AV Systems	
1	CSMP9X12	Proximity Component Storage Panel, Interface
4	S27D396GAN	32" S3 (S39GD) FHD 100Hz Curved Monitor with Speakers
4	PV100	Low profile pivot mount for flat panel monitors
1	BE98D-H	BED-H Series 98" 4K Business TV
1	XTM1U	Extra-Large Fusion Micro-Adjustable Tilt Wall Mount
1	BD-MP1MKII	Professional-Grade Blu-ray Player With SD & USB Playback
7	WPD-HD-U3C-AW	HDMI and USB-C 3.0 Pass-Through Single Gang Decorative Wall Plate with Pigtail - White
8	WPD-HD1-AW	HDMI Pass-Through Single Gang Decorative Wall Plate with Pigtail - White
5	AC-BT03-AUHD	3m 4K 18Gbps High Speed HDMI Cable
5	AC-BT02-AUHD	2m 4K 18Gbps High Speed HDMI Cable
4	BT-USBC-03	3m 4K USB 3.2 Gen 2 Type-C to Type-C Cables
4	BT-USB-A2C-02	2m USB 3.2 Gen 2 Type-A to Type-C cables
1	Floating Shelf	2ft x 12" x 3" Floating Shelf - Black
1	WiFiRocker	120W Wi-Fi Karaoke System with Sound-activated LED Woofer, 2 Wired Microphones, Bluetooth Receiver, USB/SD Interfacing
1	TSC-101-G3	10" Projected capacitive Touch Surface
3	Control 47C/T	Consistent Coverage Extended Bass Speaker, 6.5" Subwoofer, 1" Tweeter, Pair, White
1	DD-BTN44	Wall-Mounted Bi-Directional Line-Level and Bluetooth Audio Dante Interface
1	RABX2	Bluetooth and Auxiliary Input Remote Audio Mixer
1	PS-RABX2	Power Supply for RABX2
1	RAMX2	Microphone and Auxiliary Remote Audio Mixer
1	SMLV-2-LD	Surface / Table Flush Mount Low Voltage Dual Gang Vandal Proof Enclosure - Locking
1	FA-2	Single gang flange adapter to convert to flush mount configuration.
2	ADP-DAI-AU-1X0	Dante 1 Channel Analog Input Adapter
1	Custom	Misc Field Cables & Materials
1	Custom	Misc Field Installation Materials
	Admin Offices - Room 116	
	AV Systems	
1	BE75D-H	BED-H Series 75" 4K Business TV
1	LTM1U	Large Fusion Micro-Adjustable Tilt Wall Mount
1	Custom	Misc Field Cables & Materials
1	Custom	Misc Field Installation Materials
	After School Care - Room 120	
	AV Systems	
2	MX275-V5	MX (V5) Series with iQ - 75" LED-backlit LCD display - 4K - for interactive communication
2	RLXT3	Large Fit Extended Tilt Display Wall Mount
4	WPD-HD-U3C-AW	HDMI and USB-C 3.0 Pass-Through Single Gang Decorative Wall Plate with Pigtail - White
2	AC-BT03-AUHD	3m 4K 18Gbps High Speed HDMI Cable
2	AC-BT02-AUHD	2m 4K 18Gbps High Speed HDMI Cable
2	BT-USBC-03	3m 4K USB 3.2 Gen 2 Type-C to Type-C Cables
2	BT-USB-A2C-02	2m USB 3.2 Gen 2 Type-A to Type-C cables
1	TSC-101-G3	10" Projected capacitive Touch Surface
3	Control 47C/T	Consistent Coverage Extended Bass Speaker, 6.5" Subwoofer, 1" Tweeter, Pair, White
1	DD-BTN44	Wall-Mounted Bi-Directional Line-Level and Bluetooth Audio Dante Interface
1	V11HB26020	PowerLite L790SE - Short Throw 3LCD Laser Projector with 4K Enhancement, 7000-Lumen
1	100100352	Orbbec Astra 2 3D Camera
1	Custom	computer, camera, wireless keyboard, camera mount and computer mount
1	Activation Key	Activation Key
1	Rosco Adagio	Marley Floor - Grey Slate - Matt Finish 60sq. Ft
1	Custom	Projection Mount System
1	Custom	Misc Field Cables & Materials
1	Custom	Misc Field Installation Materials

Qty	Model	Description
	Data - Room 120B	
	AV Systems Equipment Rack	
1	Core 24f	Q-SYS network + analog I/O processor
1	SLDAN-16-P	Software-Based Dante License, 16-Channel, Perpetual
1	TSC-70-G3	HD Touch Screen Controller, Black
1	CS164D	4 - CH Amp - 160W per CH @ 70V Dante
1	NS26-300+	PoE+ NS Series Gen 2 Network Switches - 300W
1	SR-40-28	SR Series Large Pivoting Rack - 40RU
1	LVFD-40	40 RU Vented Front Door for SR - 64% Open
1	BR1	1U Brush Grommet Panel, 2.9" Depth
6	BL1	Flanged Aluminum Rack Blank Panel, 1U
2	VTP-1	1 RU Rack Vent Panel, Slotted with 20% Open Area
3	UTR1	1 RU Mounting Rackshelf
1	HW500	10-32 Rackscrew Trim-Head - 500 Piece
1	BL4	4 RU Flanged Blank Rack Panel, Black Brushed and Anodized Aluminum
1	PDX-915R-SP	Rackmount Power Series Surge Protection
1	WB-800-IPVM-6	800 Series IP Surge Protector | 6 Individually Controlled & Metered Outlets
1	UPX-RLNK-1500R-2	NEXSYS UPS Backup Power System Series
2	Port	Network Audio Streamer
1	G3 PLUS	Mini PC Intel N150
1	Misc	Rack Hardware
1	Misc	Misc. Wires & Connectors
	Multi-Purpose - Room 204 & Roo	
	AV Systems	
1	171-043108-01	DWU880A-GS - 1-DLP, Solid State WUXGA 1920x1200, 9, 000 lms ISO, TAA
1	140-131106-01	Lens Zoom HP G/GS 1.22-1.52
1	VCMUW	Heavy Duty Universal Projector Mount
1	CMS0305W	3-5' Adjustable Extension Column, Pole
1	CMA455	Suspended Ceiling Tile Replacement Kit
1	143024U	Ultimate Access XL V - 16:9 HDTV, 110V - 165" DIAG (76" x 140")
5	Control 47C/T	Consistent Coverage Extended Bass Speaker, 6.5" Subwoofer, 1" Tweeter, Pair, White
3	CX1277	Compact 12” Coaxial Loudspeaker - 400W @ 8 Ohms
1	FP-CX12-3X1	Fulcrum 3X1 Speaker Rigging Cluster Pack Planar Array Kit
1	CWR-18-26PD	CWR Series Data Swing Wall Rack - 18RU
1	D2	2 RU Rackmount Drawer, Black Brushed and Anodized
1	VT1	1 RU Rack Vent Panel, Perforated with 64% Open Area
1	BL3	Flanged Aluminum Rack Blank Panel, 3U
1	U1V	1U Utility Rack Mounted Shelf, 10.8" Depth, Vented Rack Shelf
1	PD-815SC-PBSH	8 Outlet, 15A, Basic Surge Protection
1	PDX-920R-SP	NEXSYS - 9 Outlet, 20 Amp Rackmount Power with Series Surge Protection
2	Axon D2i	Dante™/AES67 network audio interface (Attero Tech)
1	Core 8 Flex	Q-SYS network + analog I/O processor
1	SLDAN-16-P	Software-Based Dante License, 16-Channel, Perpetual
1	CX-Q 4K8	CX-Q Series Network Processing Amplifiers, 8-Channel
1	NS10-125+	PoE+ NS Series Gen 2 Network Switches
1	TSC-70-G3	7" Projected capacitive Touch Surface
1	AC-CX-84	ConferX 4K 8x4 Matrix Switcher
2	AC-CXWP-USBC-T	USB-C/HDMI Wall Plate Transmitter via HDBaseT
1	BD-MP1MKII	Professional-Grade Blu-ray Player With SD & USB Playback
1	SLXD24D/SM58-G58	Dual Wireless System with 2 SLXD2/58 Handheld Transmitters
2	SBC203-US	Dual Docking Recharging Station for SB903 Lithium-Ion Batteries
2	SB903	Lithium-Ion Battery for SLX-D Wireless Transmitter
1	SLXD14D-G58	Dual Wireless System with two SLXD1 Bodypack Transmitters
1	Custom	Misc Field Cables & Materials
1	Custom	Misc Field Installation Materials
	Multi-Purpose Senior A/B - Roor	

Qty	Model	Description
	AV Systems	
2	BE75D-H	BED-H Series 75" 4K Business TV
2	LTM1U	Large Fusion Micro-Adjustable Tilt Wall Mount
2	CSMP9X12	Proximity Component Storage Panel, Interface
2	TSC-101-G3	10" Projected capacitive Touch Surface
2	Axon D2i	Dante™/AES67 network audio interface (Attero Tech)
2	Control 47C/T	Consistent Coverage Extended Bass Speaker, 6.5" Subwoofer, 1" Tweeter, Pair, White
2	AC-MXNET-1G-EV2WP	MXnet 1G Evolution II Wall Plate Encoder
2	AC-MXNET-1G-DANTE-DV2	MXnet 1G Evolution II Decoder with Dante
2	Custom	Misc Field Cables & Materials
2	Custom	Misc Field Installation Materials
	AV Systems	
2	BE65D-H	65" 4K Business Pro TV, Crystal UHD Processor
2	CILT4-B1	SANUS Choice Collection Large Advanced Tilt 4D Mount
2	CSMP9X12	Proximity Component Storage Panel, Interface
1	BE425M	425VA / 225W battery backup power supply
1	UPSM-549	APC Back - UPS Wall Mount 549 - White
1	CS-BARPRO-C-K9	Room Bar Pro - video conferencing device - with Cisco Room Navigator-Table Stand
1	CS-BARPRO-MOUNT-	Mounting Kit for Cisco Room Bar Pro
1	CS-T10-WM-L-K9=	Cisco Room Navigator Wall Mount, First Light (White) - SPARE
1	CON-SNT-CST10LKW	SNTC-8X5XNBD Cisco Room Navigator-Wall Mount, First L
1	ZOOM-REC	ZOOM SolutionsPlus Package
1	WDC10	Instashow Wireless Presentation
2	WPD-HD-U3C-AW	HDMI and USB-C 3.0 Pass-Through Single Gang Decorative Wall Plate with Pigtail - White
1	AC-BT03-AUHD	3m 4K 18Gbps High Speed HDMI Cable
1	AC-BT02-AUHD	2m 4K 18Gbps High Speed HDMI Cable
1	BT-USBC-03	3m 4K USB 3.2 Gen 2 Type-C to Type-C Cables
1	BT-USB-A2C-02	2m USB 3.2 Gen 2 Type-A to Type-C cables
1	Custom	Misc Field Cables & Materials
1	Custom	Misc Field Installation Materials
	AV Systems	
2	BE75D-H	BED-H Series 75" 4K Business TV
2	LTM1U	Large Fusion Micro-Adjustable Tilt Wall Mount
2	CSMP9X12	Proximity Component Storage Panel, Interface
1	TSC-101-G3	10" Projected capacitive Touch Surface
1	Axon D2i	Dante™/AES67 network audio interface (Attero Tech)
2	Control 47C/T	Consistent Coverage Extended Bass Speaker, 6.5" Subwoofer, 1" Tweeter, Pair, White
1	AC-MXNET-1G-EV2WP	MXnet 1G Evolution II Wall Plate Encoder
2	AC-MXNET-1G-DANTE-DV2	MXnet 1G Evolution II Decoder with Dante
1	Custom	Misc Field Cables & Materials
1	Custom	Misc Field Installation Materials
	AV Systems	
4	Control 47C/T	Consistent Coverage Extended Bass Speaker, 6.5" Subwoofer, 1" Tweeter, Pair, White
1	RABX2	Bluetooth and Auxiliary Input Remote Audio Mixer
1	PS-RABX2	Power Supply for RABX2
1	RAMX2	Microphone and Auxiliary Remote Audio Mixer
1	SMLV-2-LD	Surface / Table Flush Mount Low Voltage Dual Gang Vandal Proof Enclosure - Locking
1	FA-2	Single gang flange adapter to convert to flush mount configuration.
1	ADP-DAI-AU-1X0	Dante 1 Channel Analog Input Adapter
1	SM31FH-TQG	Fitness Headset Condenser Microphone
1	BLX14/SM31-H11	Wireless Fitness Headset System with SM31FH Headset Microphone
1	Floating Shelf	1ft x 8" x 3" Floating Shelf - Black

Qty	Model	Description
1	Brush Wall Plate	Cable Pass Through, Single Gang Decorator Wall Cover for Low Voltage Cables
1	13623	Wall Adapter Power Strip with Dual USB and Dual AC Outlets | White
1	CG40059	6ft Pro-Audio XLR Male to XLR Female Cable
1	Custom	Misc Field Cables & Materials
1	Custom	Misc Field Installation Materials
	AV Systems	
4	Control 47C/T	Consistent Coverage Extended Bass Speaker, 6.5" Subwoofer, 1" Tweeter, Pair, White
1	RABX2	Bluetooth and Auxiliary Input Remote Audio Mixer
1	PS-RABX2	Power Supply for RABX2
1	RAMX2	Microphone and Auxiliary Remote Audio Mixer
1	SMLV-2-LD	Surface / Table Flush Mount Low Voltage Dual Gang Vandal Proof Enclosure - Locking
1	FA-2	Single gang flange adapter to convert to flush mount configuration.
1	ADP-DAI-AU-1X0	Dante 1 Channel Analog Input Adapter
1	SM31FH-TQG	Fitness Headset Condenser Microphone
1	BLX14/SM31-H11	Wireless Fitness Headset System with SM31FH Headset Microphone
1	Floating Shelf	1ft x 8" x 3" Floating Shelf - Black
1	Brush Wall Plate	Cable Pass Through, Single Gang Decorator Wall Cover for Low Voltage Cables
1	13623	Wall Adapter Power Strip with Dual USB and Dual AC Outlets | White
1	CG40059	6ft Pro-Audio XLR Male to XLR Female Cable
1	Custom	Misc Field Cables & Materials
1	Custom	Misc Field Installation Materials
	Data - Room 216B	
	AV Systems Equipment Rack	
1	Core 24f	Q-SYS network + analog I/O processor
1	SLDAN-16-P	Software-Based Dante License, 16-Channel, Perpetual
1	TSC-70-G3	HD Touch Screen Controller, Black
1	NS26-300+	Pre-configured NETGEAR Network Switches - 24-Port Switch
2	CS164D	4 - CH Amp - 160W per CH @ 70V Dante
1	AC-MXNET-SW24	MXnet 1G 24-Port Network Switch
1	AC-MXNET-CBOX-HA	MXnet Control Box
4	AC-1G-SFP-SM	MXnet 1G SFP with Single Mode Fiber (DUPLEX LC)
2	AC-MXNET-1G-DANTE-DV2	MXnet 1G Evolution II Decoder w/Dante
1	SR-40-28	SR Series Large Pivoting Rack - 40RU
1	LVFD-40	40 RU Vented Front Door for SR - 64% Open
1	BR1	1U Brush Grommet Panel, 2.9" Depth
6	BL1	Flanged Aluminum Rack Blank Panel, 1U
2	VTP-1	1 RU Rack Vent Panel, Slotted with 20% Open Area
3	UTR1	1 RU Mounting Rackshelf
1	HW500	10-32 Rackscrew Trim-Head - 500 Piece
1	BL4	4 RU Flanged Blank Rack Panel, Black Brushed and Anodized Aluminum
1	PDX-915R-SP	Rackmount Power Series Surge Protection
1	WB-800-IPVM-6	800 Series IP Surge Protector | 6 Individually Controlled & Metered Outlets
1	UPX-RLNK-1500R-2	NEXSYS UPS Backup Power System Series
2	Port	Network Audio Streamer
1	G3 PLUS	Mini PC Intel N150
1	Misc	Rack Hardware
1	Misc	Misc. Wires & Connectors
	Staff Lounge - Room 217	
	AV Systems	
1	BE65D-H	65" 4K Business Pro TV, Crystal UHD Processor
1	KITMTM1PC1	Fusion Medium Tilt Wall Mount Kit with MTM1U, PACPC1 and FCA110, Black
1	Apple TV 4K	Steaming Media Player (128GB)
1	Custom	Misc Field Cables & Materials
1	Custom	Misc Field Installation Materials

SECTION 275116 - PUBLIC ADDRESS SYSTEMS

PART 1 GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections with DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

B. Attention is directed Section 260400 – GENERAL CONDITIONS FOR ELECTRICAL TRADES, which is hereby made a part of this Section of the Specifications.

1.2 SUMMARY

A. Supply and install an overhead, multi-zoned public address system.

B. Related Sections:
1. Division 01 – General Requirements
2. Section 260400 – General Conditions for Electrical Trades
3. Section 270529 – Hangers and Supports for Communications Systems.
4. Section 270533 – Raceway and Boxes for Communications Systems.
5. Section 270553 – Identification for Communications Systems.
6. Section 271000 – Structured Cabling (for Ethernet cable requirements).

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. Underwriters Laboratories (UL).

C. EIA/TIA 568-B.

1.4 SYSTEM DESCRIPTION

A. Public address system for voice and music.

B. Input components:
1. Compact disc player.
2. AM/FM tuner.
3. Microphones.

C. Features:
1. Interface to telephone system.
2. One-way paging by zone.
3. Emergency paging override.
4. Distribution of background music.
5. Selective speaker talkback.
6. Exterior system for sports fields (System #2)

D. The Contractor shall furnish and install all equipment including, but not limited to, outlet boxes, wiring, speakers, and all other necessary equipment to provide a complete

operating system as indicated with the contract documents. Provide all necessary wall plates, specialty boxes, etc.

E. The Communication System shall provide distribution of intercom, overhead paging, emergency paging, tones, program material, AND on board emergency messaging.

F. The Communication System shall feature the capability to operate a system of cameras such that visual and audible communication may be synchronized.

G. Contract documents are detailed only to the extent required to show design intent. It shall be understood and agreed upon by the Contractor that all work described herein shall be complete in every detail.

H. Furnish additional items not mentioned herein to meet requirements as specified, to include hardware, rack panels, 66Blocks etc., and other devices that are required for installation.

I. Labor furnished shall be trained and experienced in telecommunication systems.

J. All equipment unless otherwise specified, shall be new, free from defects, and the best craftsmanship in its class.

K. All manufactured equipment shall be installed as recommended by the manufacturers, or as indicated in their published installation manual.

L. Furnish and install necessary equipment, backboxes, supports and enclosures.

M. Furnish and install all necessary wire.

N. Perform initial programming of system and audio level adjustments.

O. Perform final programming of system and audio level adjustments.

P. Provide information on system requirements to any Contractor responsible for supplying related materials for this system.

Q. System must be U.L. 813 and FCC Part 15 listed for safety reasons. Systems not listed as above shall not be acceptable.

1.5 SUBMITTALS

A. See Division 01 - General Requirements.

B. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.

C. Product Data: Provide data showing electrical characteristics and connection requirements for each component.

D. Test Reports: Indicate satisfactory completion of each test recommended by the manufacturer.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate that installation is complete and system performs according to specified requirements.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and Federal Communications Commission.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience

C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

D. Installer Qualifications: Authorized installer of specified manufacturer

E. Products: Listed, classified, and labeled as suitable for the purpose intended.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 CLOSEOUT SUBMITTALS

A. Division 01– General Requirements

B. Project Record Documents: Record actual locations of speakers, control equipment, and outlets for input/output connectors.

C. Operation Data: Include instructions for adjusting, operating, and extending the system.

D. Maintenance Data: Include repair procedures and spare parts documentation.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer’s instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.9 COORDINATION

A. Coordinate the installation of cable and equipment with other construction activities and the work of other sections.

1.10 WARRANTY

A. Contractor’s Warranty: Warranty the installation to be free of defect for a period of two (2) years.

B. Equipment Warranty: Each piece of equipment shall carry a two(2) year manufacturer's warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. BASIS OF DESIGN: Class Connection ES by Valcom.
2. Bogen
3. Rauland Borg
4. Simplex
5. Substitutions: Division 01 – General Requirements.

2.2 OVERHEAD PUBLIC ADDRESS SYSTEM COMPONENTS

A. Supply and install paging speakers as follows:
1. 2x2 Lay-in speakers shall be provided in areas with dropped ACT ceilings.
2. 2x2 Talk-Back speakers shall be provided in areas with dropped ACT ceilings indicated with paging talk-back switches, or where otherwise indicated, on plans.
3. In areas with gypsum or other non-accessible ceilings, provide recessed round speakers.
4. In areas without ceilings, provide surface mounted overhead speakers.
5. Pendant cylinder speakers shall be provided only where specifically indicated on drawings.
6. Interior wall speakers shall be provided where speakers are shown to be mounted on wall inside the building on the drawings.
7. Exterior wall speakers shall be provided where speakers are shown to be mounted on wall outside the building on the drawings.
8. Indoor/Outdoor Surface-mounted Horns shall be provided only in areas specifically indicated on drawings.
9. Clock/speaker baffles with 8" cone speakers shall be provided in areas specifically indicated on drawings.

2.3 LOUDSPEAKERS

A. 2x2 lay-in speakers
1. Basis of design model: Valcom V-9022A-2 One-way speaker.
2. Lay-in Ceiling Speakers shall consist of a white two foot by two foot nominal perforated grille, a speaker and integral backbox.
3. The speaker for the V -9022A-2 shall be 8" (20.32 cm) in diameter and have a 5 oz. (142 g) ceramic magnet. The 8" speaker cone material shall be paper.
4. The speaker impedance shall be 45 ohms.
5. The diameter of the voice coil shall be 75" (1.91 cm) diameter.
6. Operating temperature shall be +32 to +122 °F (0 to +50 °C).
7. Speaker shall include an amplifier assembly and volume control.
8. Distortion shall be less than 1.5% at rated output of 1 watt RMS.
9. Signal to noise ratio shall be -70dB.
10. The amplifier shall operate on a -24Vdc nominal power supply. Operating current shall be 50mA at -24 Vdc.
11. The baffle shall be constructed with a single piece of perforated steel with a white baked on acrylic enamel finish.

12. The backbox meets or exceeds A.S.T.M. E84 flame and smoke test and has a three hour burn rating (UL181). Four seismic tabs provided for additional mounting integrity.
13. Maximum dimensions of the grill shall be: Baffle 23.75 "H x 23.75 "W x 3.75 "D (60.325 cm x 60.325 cm x 9.525 cm). Weight shall be approximately 5.8 lbs. (2.61 kg).
14. A screwdriver adjustable volume control shall be provided at the center of the grill. The externally accessible control shall make it possible to adjust volume level of speaker without removal of unit.

B. 2x2 Talk-back speakers
1. Basis of design model: Valcom V-9062.
2. The V-9062 Lay-in Talkback Ceiling Speaker shall consist of a white two foot by two foot perforated grille, a speaker and integral backbox. The speaker assembly, housing and hardware shall be electrically and acoustically matched for a frequency response of 80 Hz to 15 kHz.
3. The speaker element shall be cone type with 5 oz (141.75 g) ceramic magnet. Diameter of speaker cone shall be 8.0" (20.32 cm). Voice coil diameter shall be .75" (1.91 cm). Voice coil impedance shall be 45 ohms. Speakers utilizing an 8-ohm impedance voice coil will not be acceptable.
4. The baffle shall be constructed with a single piece of perforated steel with a white baked on acrylic enamel finish. The backbox meets or exceeds A.S.T.M. E84 flame and smoke test and has a three hour burn rating (UL181).
5. Four seismic tabs provided for additional mounting integrity.
6. The maximum dimensions shall be 23.75 "H x 23.75 "W x 3.75 "D (60.325 cm x 60.325 cm x 9.525 cm). Weight shall be approximately 5.5 lbs (2.49 kg).
7. A screwdriver adjustable volume control shall be provided at the center of the grill. The externally accessible control shall make it possible to adjust volume level of speaker without removal of unit.

C. Recessed round speakers:
1. Basis of design model: Valcom V-1020C ceiling flush mounted 8" (20.32 cm) amplified speaker.
2. Unit shall include a speaker, amplifier, volume control and round grille.
3. The speaker assembly, amplifier module, housing and hardware shall be electrically and acoustically matched for a frequency response of 80 Hz to 15 kHz. The assembly shall be FCC part 68 Registered. The registration number shall be BAF917-69358-KX-N.
4. The speaker element shall be cone type with 5 oz (142 g) ceramic magnet. Diameter of speaker cone shall be 8.0" (20.32 cm).
5. Voice coil impedance shall be 45 ohms.
6. The amplifier shall have a frequency response of 80 Hz to 15 kHz.
7. Distortion shall be less that 1.5% at rated output of 1 watt RMS.
8. Signal to noise ratio shall be -70 dB.
9. The amplifier shall operate on a -24 Vdc nominal power supply. Operating current shall be 50 mA at -24 Vdc.
10. Operating temperature shall be -4 to +131 ºF (-20 to +55 ºC).
11. A screwdriver adjustable volume control shall be provided at the center of the grille. The externally accessible volume control shall make it possible to adjust volume level of speaker without removal of unit.
12. The grille shall be constructed of steel, finished in semi-gloss white enamel.

D. Surface Mounted Overhead Speakers:
1. Basis of design model: Valcom V-1920C with V-1991 square surface mount metal backbox.

2. The overhead speaker assembly shall include a speaker, amplifier, volume control and square grille. The speaker assembly, amplifier module, housing and hardware shall be electrically and acoustically matched for a frequency response of 80 Hz to 15 kHz.
3. The speaker element shall be cone type with 5 oz (142 g) ceramic magnet. Diameter of speaker cone shall be 8.0" (20.32 cm). Voice coil diameter shall be .75" (1.91 cm). Voice coil impedance shall be 45 ohms.
4. The amplifier shall have a frequency response of 80 Hz to 15 kHz. Distortion shall be less that 1.5% at rated output of 1 watt RMS. Signal to noise ratio shall be -70 dB. The amplifier shall operate on a -24 Vdc nominal power supply. Operating current shall be 50 mA at -24 Vdc. Operating temperature shall be -4 to +131 ºF (-20 to +55 ºC).
5. A screwdriver adjustable volume control shall be provided at the center of the grille. The externally accessible volume control shall make it possible to adjust volume level of speaker without removal of unit. A plastic pop off knob for volume control is included. The grille shall be constructed of steel, finished in semi-gloss white enamel. The maximum dimensions shall be: Speaker and Grille - 11.5 "Lx 11.5 "W x 3.0 "D (29.21 cm x 29.21 cm x 7.62 cm). Shipping Weight shall be approximately: Speaker and Grille: 2.6 lbs (1.17 kg).

E. Pendant cylinder speakers:
1. Basis of design model: Valcom V-1015B Pendant Speaker
2. Unit shall consist of a speaker baffle assembly designed to be suspended from a ceiling.
3. The speaker housing shall be 8.8 "H x 5.8 "Dia (22.352 cm x 14.732 cm). The speaker shall weigh 3.2 lbs. (1.44 kg).
4. The speaker housing shall be constructed of aluminum tubing and finished in a white, gray or black epoxy powder coat paint.
5. A 6 foot chain with a black finish shall be included for hanging the speaker.
6. The frequency response shall be 70 Hz to 16 kHz.
7. The output shall be 100 db, at 4 feet.
8. The amplifier shall operate on a -24 Vdc nominal power supply. Operating current shall be 300 mA at -24 Vdc.
9. Operating temperature shall be - 4 to +131 °F (-20 to +55 °C). Humidity range shall be 0-95%, non-condensing.
10. A screwdriver adjustable volume control shall be provided at the center of the grille.

F. Interior wall speakers:
1. Basis of design model: Valcom V-9852 wall speaker, with Valcom V-9807 vandal-resistant enclosure and faceplate.
2. Unit shall consist of a 45 ohm speaker, amplifier with > 600 ohm input impedance, volume control, and sloped baffle.
3. The speaker, housing and hardware shall be electrically and acoustically matched for a frequency response of 80 Hz to 15 kHz.
4. The speaker element shall be cone type with 5 oz (142 g) ceramic magnet.
5. Diameter of speaker cone shall be 8.0" (20.32 cm).
6. Voice coil impedance shall be 45 ohm.
7. The amplifier shall have a frequency response of 80 Hz to 15 kHz.
8. Amplifier audio input impedance shall be > 600 ohm.
9. Amplifier audio input shall be -10 dBM line level.
10. Distortion shall be less than 1.5% at rated output of 1 watt RMS.
11. Signal to noise ratio shall be -70 dB.
12. The amplifier shall operate on a -24 Vdc nominal, positive ground power supply. Operating current shall be 50 mA at -24 Vdc.
13. Operating temperature shall be -4 to +131 °F (-20 to +55 °C).

14. A screwdriver adjustable volume control shall be provided on the unit. This volume control shall be externally accessible, making it possible to adjust volume level of speaker without removal of unit.
15. The baffle shall be constructed of steel with a durable powder coated gray finish. The enclosure shall be paintable to match any decor.
16. Maximum dimensions of the housing shall be 10.00 "H x 12.25 "W x 4.00 "D.

G. Exterior Wall Speakers:
1. Basis of design model: Valcom V-9830 One-way stealth flexhorn.
2. Unit shall be rated for outdoor and indoor applications.
3. Unit shall have a screwdriver-adjustable volume control.
4. Unit shall be self-amplified.
5. Voice coil impedance shall be 45 ohms.
6. The amplifier shall have a frequency response of 80 Hz to 15 kHz.
7. Distortion shall be less than 1.5% at rated output of 3 watts RMS.
8. Signal to noise ratio shall be -70 dB.
9. The amplifier shall operate on a -24 Vdc nominal power supply. Operating current shall be 150 mA at -24 Vdc.
10. Unit shall be surface mounted to wall or ceiling in locations indicated on drawings. Where mounted on ceilings, the speaker shall be supported via structural steel above.
11. Enclosure shall be rectangular to provide an unobtrusive appearance. Enclosure shall measure 9.3”H x 15.0”W x 5.0”D.
12. In gymnasiums, and other areas indicated on drawings provide protective metal wire cage, sized to enclose entire speaker.

H. Indoor/Outdoor Surface-mounted Horns:
1. Basis of design model: Valcom V-1030C 5-watt amplified horn.
2. Unit shall be rated for outdoor and indoor applications.
3. Unit shall have a screwdriver-adjustable volume control.
4. Unit shall be self-amplified.
5. Output load shall be 8 ohms. Provide impedance matching devices as required.
6. The amplifier shall have a frequency response of 225 Hz to 14 kHz.
7. Distortion shall be less than 2.05% at rated output of 5 watts RMS.
8. Sound pressure level shall be 116 dB measured at 4 feet (1.22 m) on axis with an input to the amplifier module being - 10 dBm at 1 kHz.
9. The amplifier shall operate on a -24 Vdc nominal power supply. Operating current shall be 300 mA at -24 Vdc.
10. The horn shall be constructed of high impact ABS plastic. The mounting base shall be constructed of LEXAN® an ultra-high impact material which is stronger and tougher than die casting. The finish shall be beige with brown accent. The I-beam mounting clamp shall be constructed of zinc chromate plated steel.
11. Unit shall be surface mounted to wall or ceiling in locations indicated on drawings. Where mounted on ceilings, the speaker shall be supported via structural steel above.
12. Dimensions of the horn shall be 7.38 "H x 10.0 "W x 10.4 "D (18.7452 cm x 25.4 cm x 26.416 cm). Weight shall be approximately 3.6 lbs (1.62 kg).
13. In gymnasiums, pool areas and other areas indicated on drawings provide protective metal wire cage, sized to enclose entire speaker.

I. Sport Field System #2 and Loudspeakers:
1. Provide a system of amplification, speakers and microphones to enable separate channels of output by sports field. System shall reside in existing Concessions Building upper level.
2. Provide with Loudspeaker type horns; a minimum of one (1) per field.

2.4 AMPLIFICATION AND CONTROL EQUIPMENT

A. Paging system power supply:
   1. Basis of design Model: Valcom VP-6124
   2. Unit shall be a wall mounted, -24VDC power supply capable of providing 6 amperes of current. The design of this regulated power supply shall use switching technology, shall provide auto recovery short circuit protection and shall feature three(3) individual class “B” outputs each capable of providing 1/3 of the supply’s rated current. Additionally, the supply’s design shall incorporate EMI filtering, a minimum 88.5% efficiency, a 3 second power up delay, a working input frequency range of 47 to 63Hertz and an LED status indicator. The supply shall also feature +/-2% voltage regulation and over voltage protection.
   3. The supply shall be capable of operating within a temperature of 0º to 50ºC and a humidity range of 10% to 90% non-condensing.

B. Paging System Control Unit:
   1. Paging system control unit shall provide up to 360 stations of paging, emergency paging, emergency tones, time tones, group paging and music distribution. These system shall allow access from multiple telephone stations. The system shall interface with 45-ohm speakers, and can be accessed via single line phones or an E-key C.O line port. The system shall provide up to four(4) intercom links to the phone system or single line phones if used as stand-alone. The system shall have integral one-way amplifiers for group paging, all call paging, emergency paging and tones shall be standard. The system shall offer 1,2,3 or 4 digit flexible architectural numbering, dial tone, ring-back tone, alert tones, repeated alert tones, door strike contacts, evacuation tones, night ring tones, and SMDR printer port as standard equipment.
   2. The system shall provide up to 40 software programmable output contact closures to be used for activating cameras, unlocking/locking doors, and 8 contact closures to override local sound systems. The system shall also provide up to 366 switch inputs to be used for activating schedules, holiday schedules, night ringing, door ringing, activate fire tone, activate tornado tone, crisis mode, night mode, force a schedule, system time sync, activate music and program material and activate all clear tone
   3. The system shall have 8 time schedules, with up to 1024 events, that may run simultaneously. The system shall have 72 audio groups for distribution of WAV files, time tones, music, program material and emergency tones and voice announcements. These page groups shall also have emergency level dialing access to override normal page groups. The system shall provide a microphone input to be activate for an all page announcement.
   4. The system shall have the ability to store custom WAV files for emergency evacuation announcements, custom tones or school fight songs. Activation of the WAV files shall be via pushbutton, telephone dial code or through the system’s administrative software tool. Regardless of the activation method utilized, the WAV files shall feature the ability to be broadcast to any or all areas of the school as either high or low priority announcement.
   5. The system shall have a Windows Program that allows the administrative personnel to distribute music/program material and change time schedules as needed. The programming shall be accomplished from one PC through the network for multiple access.
   6. The system shall have a circuit board inside to receive US standard time signal from internet and send the signal to the clock system.
   7. The system shall be capable of playing CD and accepting an audio input from an external source such as an iPod or MP3 player.

8. The system shall have complete integration with the owner-provided VOIP telephone system for controlling and broadcasting messages over the paging speakers using telephones throughout the building.

2.5 ACCESSORIES

A. Uninterruptible Power Supply
   1. Manufacturers:
      a. Basis of design: Tripp-Lite “Smart UPS” series.
      b. Acceptable alternates: APC, Eaton.
      c. Substitutions: Division 01 – General Requirements.
   2. General Requirements: Provide UPS for paging system that meets or exceeds the following requirements:
      a. Sized to provide power to entire building’s paging system for 10 minutes after loss of power.
      b. Powered via 120VAC, dedicated receptacle shown on drawings.
      c. Has at least eight(8) NEMA 5-20 output receptacles.
   3. Mounting
      a. Mount UPS in paging rack. Provide rack mounting kit if necessary.

B. Digital Multi-Tone Generator
   1. Manufacturers:
      a. Basis of design: Valcom, model V-9927A.
      b. Substitutions: Division 01 – General Requirements.
   2. Provide a microprocessor controlled multi-tone generator capable of producing a variety of tone signals to broadcast over the paging system. Mount tone generator at the equipment head-end location, or as indicated on drawings.
   3. Equipment shall be tested and comply with the limits for a Class A digital device pursuant to Part 15 of FCC Rules.
   4. Power Requirements: -24VDC “B” Battery at 100mA
   5. Nominal Input/Output Specifications:
      a. Input Impedance: 600 Ohms
      b. Output Impedance: Less than 4 Ohms
      c. Min. Output Load Impedance: 20 Ohms
      d. Audio Input: 0dBm nominal
      e. Maximum Tone Output: >0dBm single tone
   6. Operating Environment:
      a. Temperature: 0 to +50° C
      b. Humidity: 0 to 85% (non-condensing)
   7. Provide programming, configurations, optimization, etc. to broadcast specific tones over the paging system when receiving an input through the clock system interface. Provide all necessary interconnections.

C. Telephone Interface: 600 ohm - auxiliary input.
   1. Provide all required equipment by manufacturer of public address system for integration with owner-provided phone system.
   2. Provide all required interconnections with phone system.

D. Equipment Rack: Floor mounted equipment rack. Provide dedicated equipment rack for public address system, unless specifically indicated on drawings:
   1. Provide 4-post equipment cabinet to meet the specifications listed in Section 27 1000 – Structured Cabling.
   2. Equipment Mounting Width: 19 inch (483 mm).
   3. Equipment Mounting Height: 45RU
   4. Finish: Gray enamel finish.
   5. Include front hinged and latched door.

6. Include six receptacle multioutlet assembly inside rack, 20A, 120VAC.

E. Provide IP-based desktop master telephone for complete control of system.

F. Cutoff Switches
1. Provide wall switch to temporarily disable paging to the speakers within the room in which the speakers are located.
2. Wire speakers within room to the "load" side of cutoff switch.
3. Provide all necessary low-voltage relays and associated wiring to accomplish temporary cutoff function.
4. Provide a single pole toggle switch mounted at typical building controls height.
   a. Switch shall be rated for 20A at 120V/1P.
   b. Switch shall have integral pilot light to activate when in the ON position.
   c. Mount in 2-gang box with 3/4" conduit stubbed to nearest accessible ceiling.
   d. Refer to section 262726- Wiring Devices for additional specifications.
5. Provide laminated signage under switch:
   a. Labeled: "PAGING SYSTEM CUTOFF SWITCH".
   b. Refer to section 260553-Identification for Electrical Systems for further labeling specifications.

G. Volume Pads: Transformer type rated 10 watts.
1. Provide rotary-style volume control knob in each room or area with speakers (minimum one volume controller per space served by speakers).
2. Mount in standard 2-gang electrical box at building controls height.
3. Provide model equal to manufacturer of public address system.
4. Volume control knob shall be wired in series with speakers in same room.
   a. Lights for lockdown notification shall be provided with an amber dome.

H. Compact Disc Player
1. Provide compact disc player compatible with public address system. Locate in PA equipment rack and provide all necessary interconnections to system.

I. AM/FM Tuner: Tuner with 525 to 1605 kHz AM and 88 to 108 MHz FM tuning range.
1. AM Performance:
   a. AM IF Rejection: Over 30 dB.
   b. AM Selectivity: 7 kHz at minus 6 dB.
   c. AM Fidelity: 100 to 4500 Hz, plus or minus 3 dB.
   d. AM Antenna Input: 75 ohms, unbalanced.
2. FM Performance:
   a. FM IF Rejection: Over 50 dB.
   b. FM Fidelity: 50 to 15,000 Hz, plus or minus 3 dB.
   c. FM Antenna Input: 300 ohms, balanced.
3. Antenna: Folded dipole FM antenna.
   a. Impedance: 300 ohm with matching transformer for 75 ohm coaxial cable.
   b. Construction: Use tubular metal elements.
   c. Wind Resistance: Withstand 100 mph wind.

2.6 WIRE AND CABLE

A. Speaker Cable: Supply and install cable between head-end equipment and speakers indicated on the drawings.

B. Microphone Cord: Unless otherwise noted on drawings, provide 20 AWG stranded copper conductor, 600 volt insulation, rated 60 degrees C, two conductor shielded cable with rubber jacket.

C. Input Cable: Unless otherwise noted on drawings, provide 22 AWG copper conductor, 300 volt insulation, rated 60 degrees C, paired conductors twisted together, shielded, and covered with a PVC jacket.

D. Plenum Cable for Speaker Circuits: Unless otherwise noted on drawings, provide 22 AWG copper conductor, 300 volt insulation, rated 200 degrees C, paired conductors twisted together shielded and covered with a nonmetallic jacket; suitable for use for Class 2 circuits in air handling ducts, hollow spaces used as ducts, and plenums.

2.7 EMERGENCY ALERT SYSTEM

A. Emergency alerts shall be initiated and managed through the Access Control/Integrated Security system and shall be integrated with the building public address system.

B. Upon Activation, system shall provide a distinctive audio tone for a short duration utilizing the overhead paging system speakers. Audio shall be unmistakably distinctive form the other overhead paging tones. System shall also override all local sound systems in building.

C. Distinctive Tone Generator

1. The tone shall be sent over the overhead paging speaker system.
2. The tone is completely distinct from the class change tone and be of an “urgent” nature such as a warble tone. The tone is to be played for a period of 2 to 4 seconds for each actuation and be adjustable.
3. Voice message shall following emergency tone and read the following (coordinate with owner to confirm, prior to installation):
   A. Alert Message: Attention. Code Red. An emergency has been reported in the building or this vicinity.
   B. All Clear Message: All clear. Code White. Resume normal activities. Thank you.

D. System shall include hard-wired connections and individual components, a preprogrammed configuration of the page system, or a combination of both.

E. System shall have battery back-up and shall be supported for 90 minutes of stand-by time and 5 minutes of activation time.

F. Provide all necessary components and wiring for a complete operational system. Coordinate with the telephone vendor for any interconnection, preprogramming or wiring to dial direct to 911 emergency call center.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mounting Heights:

1. Wall mounted interior speaker: 6” below ceiling/structure unless otherwise noted on drawings.
2. Wall mounted exterior speaker: 10 feet above finished grade unless otherwise noted on drawings.

C. Splice cable only in accessible junction boxes or at terminal block units.

D. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.

E. Install input circuits in separate cables and raceways from output circuits.

F. Leave 18 inches (300 mm) excess cable at each termination at microphone, volume pad, speaker, and other system outlet.

G. Provide protection for exposed cables where subject to damage.

H. Outside speaker circuits shall be run in rigid steel conduit.

I. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use spring metal clips or plastic cable ties to support cables from structure for ceiling suspension system. Include bridle rings or drive rings.

J. Use suitable cable fittings and connectors.

K. Connect reproducers to amplifier with matching transformers.

L. Install equipment racks in location shown; arrange to provide adequate ventilation and access.

M. Ground and bond equipment and circuits in accordance with Section 260526.

N. Configure the paging system with an all-call with priority override.

O. At each speaker location, form a four (4) foot coil of slack cable prior to each termination point. In the telecom closet, form a ten (10) foot coil of slack cable prior to termination point. Tag and identify cable by means of firm, visible machine labels at the originating end and at each speaker termination. Mount the amplifiers and control unit on a backboard located in the primary telecom closet. The vendor shall be responsible for system activation, interface with the telephone system, local public address systems (for override) and system balancing. Provide 66-blocks adjacent to head-end rack for termination of speaker cabling. Provide Amphenol cables to connect 66-blocks to head-end amplification equipment.

3.2 ZONING

A. Public address speaker cabling will originate in the head-end rack and shall be wired for the following zones:

1. Gymnasium
2. Pool Areas
3. Exterior (non-pool) Areas
4. Interior General
5. Second Floor Multi-Purpose Room

3.3 TESTING

A. Upon completion of the system installation, provide walk-through with Owner's representative in each space with public address system speakers. Demonstrate speaker operation in each room using a similar test signal. Provide final volume adjustment of speakers in each space per Owner's direction.

B. Upon completion of the system installation, align, adjust and balance the system. Determine that the system conforms to the requirements of the Drawings and specifications. Correct all deficiencies and replace malfunctioning or damaged items. Repeat testing until all materials and equipment perform satisfactorily and the system requirements are achieved.

C. Provide a written record of test results to the owner within 10 days of the completion of these tests.

D. Provide all necessary test equipment required for proper facilities testing as outlined below. Adjust levels, frequency attenuators, and matching devices to achieve system performance.

E. Impedance and Phase
1. Check all speaker line paths for proper polarity, make all lines uniform.
2. Measure and record all installed speaker lines, at audio equipment rack, for proper impedance. Document all measurements.
3. Check for proper polarity of all installed speakers, or speaker components.
4. Make any and all required changes to provide correct operation of above.

F. Hum and Noise
1. All Hum and Noise shall be inaudible under normal operating conditions. Corrections must be completed prior to any further testing.

G. Buzzes, Rattles, and Distortion
1. The sound system shall be free of any rattling, mechanical noises, or distortion caused by improper installation. In addition, if under testing it is discovered that external noises are cause from other trades related to this installation or not, it must be brought to the attention of the owner or owner's agent.

H. Acoustical Measurements
1. A Real Time Audio Spectrum Analyzer shall be used with a pink noise source to complete the required testing. A field technician trained in use of this machine is required. All acoustical testing shall be completed after all interior finishes have been done.
2. Frequency Response shall be flat from 60 Hz to 4K Hz + or – 4 dB including no peaks outside of this parameter. Roll off above the outlined range shall be at 3 dB per octave from the 4K Hz to 12.5K Hz. The Real Time Analyzer shall be placed in a minimum of 6 locations to comply with above frequency curves.
3. Coverage shall be uniform. Using a pink noise source, measurement shall be taken at the above 6 locations and at an additional 6 random points. Level shall be uniform within 6 dB.

I. Listening Test
1. May include surveys and subjective testing of intelligibility at random locations under operating conditions. Testing will include live voice quality, recorded speech playback, program playback, and playback of locally recorded program within system.

3.4 DOCUMENTATION

A. Provide copies of all manuals and two (2) sets of as-built documents, in hard copy and electronic format. As-built documentation shall include location and types of hardware provided and installed as well as the interconnection of each device.

3.5 TRAINING:

A. The Owner may assign personnel to participate with the contractor during installation. Without delaying the work, familiarize the Owner's personnel with the installation, equipment, and maintenance.

B. Provide training to personnel selected by the Owner on operation and basic maintenance of all systems and equipment.

C. Include **4 hours** of training Owner’s staff.

END OF SECTION

SECTION 275319 - DISTRIBUTED ANTENNA SYSTEM (DAS)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This specification describes technical and performance criteria for deploying a Neutral-Host Distributed Antenna System (DAS) capable of supporting Wireless Service Providers (WSP) and Public Safety Networks (PSN). The DAS components specified in this document include: Donor Antennas, Coverage Antennas, Coax Cable, Coax Connectors, Splitters, Combiners, Couplers, Fiber-Optic Cable, Fiber-Optic Connectors, and Fiber-Optic Jumpers, Bi-Directional Amplifiers (BDA), Fiber-Optic Master Unit and Fiber-Optic Remote Units.

1.2 SYSTEM DESCRIPTION

A. Contractor shall carry a line item in bid for a new DAS (BDA) system for the Pompey Park Community Center. After testing , should a DAS system be required, the installation shall comply with these specifications and project plans.

B. Services: Upon commissioning, the DAS shall provide coverage for the PSNs listed below on all frequencies currently being used by the designated PSN in the Town of Delray Beach. All frequencies are to be confirmed with the Town of Delray Beach and additional PSN frequencies added as required.

C. WSP Approval: The Contractor shall propose and deploy a DAS system capable of receiving WSP Approval for interconnection to the WSPs' macro networks.

D. PSN Approval: The Contractor shall propose and deploy a DAS system capable of receiving approval of the PSN Authority Having Jurisdiction (AHJ).

E. Broadband Active Distribution: Single-mode fiber-optic cable will be used for Active distribution. In-line amplifiers are not allowed.

F. Network Management:
1. NMS: The DAS shall have a Network Management System (NMS) capable of alarm, monitor, configuration and control of all Active Components.
2. SNMP Integration: The DAS NMS shall be capable of integration with 3rd party SNMP based NMS products for alarm purposes and provide alarming information.

1.3 MANUFACTURERS

A. The following information shall be required for each component with submittal of the bid response:
1. Passive Components:
a. Product samples
b. Detailed product specifications
c. Independent test results verifying the product specifications

d. Written documentation from the manufacturer guaranteeing that the alternative component(s) shall remain available for new purchase for a period of 7-years from the date of system acceptance.

2. Active Components:
   a. Hardware and software manuals
   b. Detailed product specifications
   c. Mean Time Between Failure (MTBF) data for each Active Component
   d. Independent test results verifying the product specifications
   e. Written documentation from the manufacturer guaranteeing that the alternative component(s) shall be supported for a period of 7-years from the date of system acceptance.
   f. For Active Components serving the WSPs, written documentation from the WSPs that the alternative component(s) are approved for use within the WSP's network and that interconnection of the DAS to the WSP's network will not be withheld due to the alternative component being used in the DAS.
   g. For Active Components serving the PSN, written documentation from the AHJ that the alternative component(s) are approved for use within the PSN and that system acceptance of the DAS to the PSN will not be withheld due to the alternative component being used in the DAS.

1.4 CODES, STANDARDS AND CERTIFICATIONS

A. All work, including but not limited to: cabling, pathways, support structures, wiring, equipment, installation, workmanship, maintenance and testing shall comply with the latest editions of the National Electrical Code, National Electrical Safety Code, all applicable local rules and regulations, equipment manufacturer's instructions, and the National Electrical Contractor's Association (NECA) Standard of Installation. In case of discrepancy or disagreement between the documents noted above, the contractor shall satisfy the most stringent requirements.

B. Requirements set forth by first-responder code, ordinance, or the PSN AHJ shall supersede the requirements described herein and shall be met in their entirety. It is the Contractor's responsibility to ensure that the DAS complies with local code, ordinances or requirements established by the PSN AHJ.

C. **Provide system documents in accordance with AHJ requirements as follows**:

1. Site plan with address and scope of work. It should also include code cycles and all local amendments referenced for design purposes.

2. Per floor pre-liminary RF scan of building. Actual downlink reading with use of mathematical formula used to calculate up link signal. PBC uses 100-watt amplifiers at their towers. Use of “typical floor plans” for multi-story buildings will NOT be accepted – each floor must be shown.

3. Riser diagram of all system components to be shown. A clearly labelled legend shall be included on this page to ensure plan reviewer will not have to guess what each symbol on the riser indicates.

4. Per floor lay out of equipment install, include legend to easier reference to symbols. Again the use of “typical floor plan” NOT acceptable- each floor must be shown.

5. Wave map(s)

6. Battery Calculations- PBC FR amendment requires a 24 hour run time

7. Listing of ALL equipment (except conduit if used) including wiring. This part of the submission should also include UL listing for penetrations through floors, ceiling, and walls 8) At time of inspection- final RF scan of building with system turned on.

8. Please note that this is the BASIC REQUIREMENTS for plans submission. Contractor shall be responsible to include any other information deemed necessary per code, amendments, and manufacturers recommendations to supply a detailed, complete, and concise permitting package of the system as it will be designed and installed.

9. *****Note: Should a building NOT require a BDA system the RF scan shall still be taken and be accompanied by a letter from a Registered Professional Engineer stating as such. This letter and the RF scan shall be Signed and Sealed by said Engineer.

1.5 ABBREVIATIONS AND ACRONYMS

A. ACG: Automatic Gain Control

B. AHJ: Authority Having Jurisdiction

C. ATP: Acceptance Test Plan

D. AWS: Advanced Wireless Service

E. BDA: Bi-Direction Amplifier

F. BOM: Bill-of-Material

G. BRS: Broadband Radio Service

H. BTS: Base Transceiver Station

I. CDMA: Code Division Multiple Access

J. C/N: Carrier-to-Noise Ratio

K. CWDM: Coarse Wave Division Multiplexing

L. DAS: Distributed Antenna System

M. DWDM: Dense Wave Division Multiplexing

N. EBS: Educational Broadband Service

O. ESMR: Enhanced Specialized Mobile Radio

P. FCC: Federal Communications Commission

Q. GUI: Graphical User Interface

R. iDEN: Integrated Enhanced Digital Network

S. LMR: Land Mobile Radio

T. LTE: Long Term Evolution

U. MTBF: Mean Time Between Failure

V. NFPA: National Fire Protection Association

W. NMS: Network Management System

X. PCS: Personal Communications System

Y. PSN: Public Safety Network

Z. RoF: Radio-over-Fiber

AA. RoHS: Restriction of Hazardous Substances

BB. RSL: Received Signal Level

CC. SISO: Single-Input, Single-Output

DD. SMR: Specialized Mobile Radio

EE. SMS: Short Message Service

FF. SNIR: Signal-to-Noise Interference Ratio

GG. SNMP: Simple Network Management Protocol

HH. SOW: Statement of Work

II. VSWR: Voltage Standing Wave Ratio

JJ. WSP: Wireless Service Provider

1.6 DEFINITIONS

A. Acceptance: Expressed approval by the customer

B. Active: DAS components that require AC/DC power for operation

C. Carrier Approval: Expressed approval to interconnect to the WSP macro network

D. Channel: A path for an RF transmission between two points

E. Component: A main system element of the DAS

F. Contractor: The prime contractor bidding the project

G. Passive: DAS components that do not require AC/DC power for operation

1.7 PERFORMANCE REQUIREMENTS

A. WSPDAS:

1. On a per channel basis, the downlink RSL for each frequency band shall meet or exceed the criteria in Table 1.

Table 1. System Parameters

Parameters	**Units**	**Lower 700 Band BRS/EBS**	**Cellular, PCS, AWS Commercial 800**	**Public Safety 512, 700, 800 MHZ**
Minimum downlink received signal level (RSL)	dB	-77	-85	-95

2. Contractor shall state the assumed channel loading and frequency bands for the proposed WSP in-building coverage. Prior to installation, contractors shall confirm the channel loading and frequency use in the serving area, and shall guarantee coverage for these channels per the criteria in Table 1.
3. The DAS shall deliver coverage per the criteria in Table 1 throughout 95% of the building. The coverage areas shall include the stairwells, elevators, basement, and garage.
4. The contractor shall explain the method used to avoid downlink and uplink interference.

B. PSN DAS:

1. The PSN DAS shall comply with NFPA-1 2009 Edition.
2. Where the in-building coverage requirements include 700 - 800 MHz public safety system and commercial wireless in-building coverage, the two systems shall operate over a unified Passive Cable and Coverage Antenna Infrastructure.
3. Contractors shall state the assumed channel count for the PSN Frequency Bands identified above in Section 1.2 A. with submittal of bid response. Prior to installation, contractors shall confirm the channel count and frequencies with the AHJ, and shall guarantee coverage for these channels per the criteria stated above.
4. The DAS shall be capable of upgrade, without additional hardware or software, to allow for changes to system frequencies within the deployed frequency band in order to maintain radio system coverage as originally designed.
5. The contractor shall explain the method used to avoid downlink and uplink interference.

1.8 ADDITIONAL REQUIREMENETS

A. WSP Approval: The Contractor shall be responsible for providing the WSP with information each WSP requires to approve interconnection of the DAS to the WSP's macro network.

B. PSN Approval: When approval of the DAS deployment is required by code or ordinance, the Contractor shall be responsible for facilitating the AHJ approval(s) per the requirements of the code or ordinance.

1.9 SUBMITTALS

A. Submittal Requirements with Bid Response:
   1. Product Data: Submit manufacturer datasheets for the following components:
      a. Donor and Coverage Antennas
      b. Coaxial Cable and Connectors
      c. Splitters, Combiners and Couplers
      d. Bi-Directional Amplifiers (BDA)
      e. Fiber-Optic Master Unit
      f. Fiber-Optic Remote Units
   2. Shop Drawings: Submit the following items:
      a. RF link budget
      b. Overlay of system Components on floor plans
      c. Drawings for Donor Antenna and grounding
      d. Bill-of-Material (BOM)
   3. Statement of Work (SOW): Submit sample SOW
   4. Acceptance Test Plan (ATP): Submit sample ATP
   5. Recommended Spares
   6. Warranty Documents:
      a. Submit for all manufactured Components specified in this Section.
      b. Submit Contractor's System Warranty.
      c. Submit Manufacturer's Extended Warranty.

B. Submittal Requirements Prior to Start of Construction
   1. Final RF link budget
   2. Overlay of system Components on floor plans
   3. Drawings for Donor Antenna and grounding
   4. RF propagation modeling
   5. Signal to Noise Interference Ratio (SNIR) Map
   6. Bill-of-Material (BOM)
   7. Maintenance Service Contract
   8. Statement of Work (SOW): The contractor shall submit a SOW that has been accepted by the customer or customer's designated representative.
   9. Acceptance Test Plan (ATP): The contractor shall submit an ATP that has been accepted by the customer or customer's designated representative.

C. Submittal Requirements at Close Out
   1. Drawings: Submit as-built drawings indicating:

a. Donor antenna, grounding and lighting protection details
b. Cable routing, splitters, couplers and coverage antenna locations
c. Active component locations, layout and configuration

2. Test Reports
   a. WSP DAS: Submit accepted ATP reports confirming the requirements of Section 1.7 A have been met.
   b. PSN: Submit Accepted ATP reports confirming the requirements of Section 1.7 B have been met.
3. Field Reports: Submit sweep-testing results for all cable runs.
4. Field Reports: Submit OTDR test results for all fiber runs.
5. Operation and Maintenance Data: Submit hardware and software manuals for all Active Components.
6. Warranty Documents:
   a. Submit for all manufactured components specified in this Section.
   b. Submit Contractor's System Warranty.
   c. Submit Manufacturer's Extended Warranty

1.10 QUALITY ASSURANCE

A. Qualifications: Contractor, and/or Sub-Contractors, shall have a minimum of 5-years full-time experience executing work of similar scope and complexity.

B. Certifications:
   1. Passive Components: Contractor or Sub-Contractor shall provide manufacturer certification that their personnel have been trained on the components being installed.
   2. Active Components: Contractor or Sub-Contractor shall provide manufacturer certification that their personnel have been trained on the components being installed.

1.11 WARRANTY

A. Manufacturer Warranty:
   1. Splitters, Couplers and Coverage Antennas: 5-year limited warranty from date of system acceptance.
   2. Coaxial Cable and Connectors: 10-year limited warranty from date of system acceptance.
   3. Fiber-Optic Cable: 20-year limited warranty from date of system acceptance.
   4. Active Components: 1-year limited warranty from date of system acceptance.

B. Contractor Warranty: Contractor shall warrant the system performance as specified in Section 1.7 for 1-year.

C. Manufacturers Extended Warranty:
   1. The DAS shall be covered by a two-part certification program provided by a single manufacturer and that manufacturer's certified contractor. The certification program covers a certified system defined as a DAS installation performed by a certified contractor using components conforming to Section 2.1

following all the manufactures recommendations, installation instructions and best practices. Manufacturer shall administer a follow-on program through the contractor to provide support and service to the purchaser. The first part is an assurance program, which provides that the certified system will support current and future modulation formats in the frequency bands for which it is designed, during the 20-year warranty of the certified system.

2. The second portion of the certification is a 20-year warranty provided by the manufacturer and the contractor on all cable products within the system (fiber-optic cable, coaxial riser cable, plenum coaxial cable and associated connectors, etc.). In conflict with 1.11 A 3 where we say the fiber has a 20 year warranty
3. In the event that the certified system ceases to support the certified application(s), whether at the time of ATP, during normal use or when upgrading to additional frequency bands, the manufacturer and Contractor shall commit to promptly implement corrective action.
4. Manufacturer shall maintain ISO Quality Control registration for the facilities that manufacturer the products used in the DAS.

1.12 MAINTENANCE

A. The Contractor shall provide an optional maintenance service contract, covering for a period of one-year: preventative maintenance, system monitoring, spares, fault mitigation, equipment repair, and response time.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: As permitted in Section 1.3.

2.2 COMPONENTS

A. Broadband Donor Antennas: Broadband Donor Antennas shall feature a multi-band design, accommodating Cellular, PCS, LMR and AWS frequencies in a single small antenna.
   1. Electrical:
      a. Frequency bands, 806 - 960 MHz and 1710 - 2200 MHz
      b. VSWR≤; 1.8
      c. Gain: 806-960≥10.5 dBi, 1710-2200≥12 dBi
      d. Maximum input power: 100 watts
      e. Polarization: Vertical
      f. Front-to-back ratio: 806 - 960≥18 dB, 1710 - 2200≥20 dB
      g. Impedance: 50 Ω
      h. Azimuth Pattern: As proposed by the manufacturer to meet the performance specifications in this Section.
   2. Mechanical:
      a. Radome material: UV-protected ABS
      b. Pigtail cable: RG58, plenum rated

c. Connector: 50Ω N Type Female
d. Mounting: Pole

3. Environmental
a. Temperature: -40 °C to +60 °C
b. Lighting protection: Direct ground
c. Waterprooflevel: IP 66
d. Wind Speed, maximum: 125 mph

4. Approved Manufacturer In accordance with Section 1.3

B. 700 MHz LMR Yagi Donor Antennas:

1. Electrical:
a. Frequency band, 746 - 806 MHz
b. VSWR: ≤ 1.5:1
c. Gain: ≥ 1 1.1 dBi
d. Maximum input power: 100 watts
e. Polarization: Vertical
f. Front-to-back ratio: ≥ 15 dB
g. Impedance: 50 Ω
h. Beamwidth, Horizontal, degrees: 60
i. Azimuth Pattern: As proposed by the manufacturer to meet the performance specifications in this Section.

2. Mechanical:
a. Connector: 50 Ω N Type Female
b. Mounting: Pole

3. Environmental:
a. Temperature: -40 °C to +60 °C
b. Lighting protection: Direct ground
c. Waterprooflevel: IP 66
d. Wind Speed, maximum: 125 mph

4. Approved Manufacturer In accordance with Section 1.3

C. Omni-Directional Coverage: Omni-Directional Coverage antennas shall feature a multi-band design, accommodating multiple frequency bands in a single small antenna.

1. Electrical Band 1:
a. Frequency Band: 698 - 800 MHz
b. VSWR: ≤ 1.8:1
c. Gain: ≥: 1.5 dBi
d. Maximum input power: 100 watts
e. Impedance: 50 Ω
f. Beamwidth, Horizontal: 360° omnidirectional
g. Beamwidth, Vertical: 80° nominal
h. Return Loss: 10.9 dB

2. Electrical Band 2:
a. Frequency Band: 1710 - 2700 MHz and 800 - 960 MHz
b. VSWR: ≤ 1.5:1
c. Gain: ≥ 1.5 dBi@ 800--960 MHz and ≥: 5.0 dBi@ 1710 - 2700 MHz

d. Maximum input power: 100 watts
e. Impedance: 50 Ω
f. Beamwidth, Horizontal: 360° omnidirectional
g. Beamwidth, Vertical: 65° nominal
h. Return Loss: :≤ 13.9 dB

3. Mechanical:
   a. Connector: 50 Ω N Type Female
   b. Mounting: Thru-hole ceiling mount
   c. Radome material: ABS, UV resistant
   d. Pigtail cable: KSR195, plenum rated
4. Environmental:
   a. Application: Indoor
   b. Operating Temperature: 40 °C to +60 °C (40 °F to +140 °F)
   c. Relative Humidity: Up to 100%
5. Regulatory Compliance/Certifications: RoHS 2002/95/EC
6. Approved Manufacturer In accordance with Section 1.3

D. Directional Coverage Antennas: Directional coverage antennas shall feature a multi-band design, accommodating multiple frequency bands in a single small antenna.

1. Electrical Band 1:
   a. Frequency Band: 698 - 800 MHz
   b. VSWR: ≤ 1.8:1
   c. Gain: 5.0 dBi @ 698 - 800 MHz
   d. Maximum input power: 50 watts
   e. Impedance: 50 Ω
   f. Beamwidth, Horizontal: 110° nominal
   g. Polarization: Vertical
   h. Return Loss ≤ 10.9 dB
2. Electrical Band 2:
   a. Frequency Band: 1710 - 2700 MHz and 800 - 960 MHz
   b. VSWR≤ 1.5:1
   c. Gain:≥5.0 dBi @ 800 - 960 MHz and ≥ 6.0 dBi@ 2170 - 2700 MHz and ≥ 8.0 dBi@ 1710-2170 MHz
   d. Maximum input power: 50 watts
   e. Impedance: 50 Ω
   f. Beamwidth, Horizontal: 90° nominal
   g. Return Loss ≤ 13.9 dB
3. Mechanical:
   a. Connector: 50 n N Type Female
   b. Mounting: 4-hole wall mounting plate
   c. Radome material: ABS, UV resistant
   d. Pigtail cable: RG58, plenum rated
4. Environmental:
   a. Application: Indoor
   b. Operating Temperature: 40 °C to +60 °C (40 °F to +140 °F)
   c. Relative Humidity: Up to 100%

5. Regulatory Compliance/Certifications: RoHS 2002/95/EC
6. Approved Manufacturer In accordance with Section 1.3

E. Fiber-Optic Cable and Connectors:
1. General Specifications:
a. Cables shall be six-strand or greater, designed for point-to-point applications as well as mid-span access, and shall provide a high-level of protection for optical fiber installed in interior building environments.
b. Higher optical fiber count cables shall utilize a sub-unitized design with color- coded subunits for easy identification.
c. Single-mode optical fibers shall be 8.3 µm and use standard colored tight- buffered construction.
d. The single-mode optical fiber shall be dispersion-unshifted optical fiber that meets ITU-T G.652c standards.
e. Cable shall provide optimum performance over entire wavelength range from 1260 to 1625 nanometers.
f. Cable shall support new and emerging applications that utilize extended E band, 1360 to 1460 nanometers.
g. Cable shall also support existing and legacy single-mode applications that traditionally operate in 1310 and 1550 nanometer regions.
h. Cable shall deliver a cost-effective upgrade path by expanding available wavelengths by 50 percent supporting 16 Channels of coarse wave division multiplexing (CWDM) on a single optical fiber and up to 400 Channels of dense wave division multiplexing (DWDM) on a single cable.
i. Fire ratings: Riser, plenum, and/or LSZH

F. Fiber-Optic Pigtails:
1. General Specifications:
a. To maintain channel integrity, optical fiber patch cords and pigtails shall be fabricated to meet the performance parameters corresponding to the optical fiber cable approved product type specified below. Patch cord and pigtail plug connectors shall be equipped with boots, and shall have same colors as related optical fiber backbone cables, unless specified or indicated otherwise. Optical fiber patch cords and pigtails shall be available with the following options as specified or indicated:
1) Termination types: SC-APC
2) Connector/cable configuration: Simplex and duplex
3) Fire ratings: Riser, plenum and/or LSZH
4) Patch cord outside diameters: 1.6 millimeters (0.063 inches) and 3.0 millimeters (0.118 inches)
5) Pigtails: Ruggedized and tight-buffered optical fiber-0.9 millimeters (0.035 inches) outside diameter
6) Lengths: As specified or indicated
7) Approved Manufacturer In accordance with Section 1.3

G. Air Dielectric, Plenum Rated Cable:
1. Material Characteristics:
   a. Jacket: Halogenated, Fire-Retardant
   b. Outer Conductor Material: Corrugated Aluminum or Corrugated Copper
   c. Inner Conductor Material: Copper-Clad Aluminum Wire
2. Electrical Characteristics:
   a. Impedance: 50 ± 2.0 Ω
   b. Frequency Band: 1 - 8800 MHz
   c. Peak Power Rating: 2: 40.0 kW
3. Mechanical Characteristics:
   a. Diameter Over Jacket:≤ .627 in
   b. Minimum Bending Radius: ≤ 5 in
   c. One Time Minimum Bending Radius: ≤ 3 in
4. Attenuation Characteristics:

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.848
450	≤ 1.53
800	≤ 2.105
2000	≤ 3.564

Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68 °F)
Approved Manufacturer In accordance with Section 1.3

H. Foam Dielectric Cable:
1. Material Characteristics:
   a. Jacket: Non-halogenated, Fire-Retardant Ployolefin
   b. Outer Conductor Material: Corrugated Copper
   c. Inner Conductor Material: Copper-Clad Aluminum Wire or Copper Tube
2. Electrical Characteristics:
   a. Impedance: 50 ± 1.0 Ω
   b. Frequency Band: 1/2" Nominal: 1 - 8800 MHz, 7/8" Nominal: 1 - 5000 MHz
   c. Peak Power Rating: ≥: 40.0 kW
3. Mechanical Characteristics:
   a. Diameter Over Jacket: 1/2" Nominal: ≤.630 in, 7/8" Nominal: ≤ 1.1 in
   b. Minimum Bending Radius: 1/2" Nominal: ≤ 5 in, 7/8" Nominal: ≤ 10 in
   c. One Time Minimum Bending Radius: 1/2" Nominal: ≤2 in, 7/8" Nominal: ≤ 5 in
   d. Approved Manufacturer In accordance with Section 1.3
4. Attenuation Characteristics: 1/2" Nominal

Frequency (MHz)	Attenuation (dB/100ft)

150	≤ 0.815
450	≤ 1.447
800	≤ 1.968
2000	≤ 3.251

Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68 °F)

5. Attenuation Characteristics: 7/8" Nominal:

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.417
450	≤ .744
800	≤ 1.014
2000	≤ 1.683

Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68 °F)

I. Splitters, Combiners, Couplers, Coax Jumpers and Connectors:
   1. Approved Manufacturer In accordance with Section 1.3.

J. BDA: When the AHJ and/or WSP dictates a BDA drive the DAS, the BDA shall be of modular design and use digital filtering to mitigate interference and accommodate multiple services for PSNs and WSPs.
   1. Characteristics
      a. Operating Temperature Range: -33 °C to +50 °C
      b. Chassis: Shall be of modular design with ≥: 4 frequency bands per 19" chassis. Chassis shall not exceed four Rack Units (RUs) in height.
      c. Filtering: Digital
      d. Separate Control: Each RF amplifier shall be capable of adjusting and controlling power levels for each WSP when multiple WSPs share a single amplifier.
      e. FCC Part 90.219 Type Classification: Class A narrowband for LMR/SMR/ESMR frequency bands
      f. Alarming: Shall support both SNMP and SMS using wireless modem
      g. Mounting Options: shall support rack, wall and pole mounting
      h. Frequency Bands Supported: 380 - 512 MHz LMR, 769 - 806 MHz LMR, 806 - 869 MHz LMR/SMR/ESMR, 896 - 941MHz LMR/SMR/ESMR, 824 - 894 MHz Cellular, 1710 - 1755 MHz AWS, 1900 - 1950 MHz PCS
   2. Compliance:
      a. NFPA: The BDA shall comply with NFPA-1 2009 edition Annex O In-Building Public Safety Radio Enhancement Systems.
      b. FCC: Shall be FCC type certified.
   3. Approved Manufacturer In accordance with Section 1.3

K. Fiber-Optic Master Unit: When building size dictates an Active fiber DAS, the Fiber-Optic Master Unit shall convert radio over coax to Radio-Over-Fiber (RoF) for distribution to Fiber-Optic Remote Units.

1. Characteristics
    a. Transmission Media: Single-mode fiber at 1310 nm
    b. Operating Temperature Range: +5 °C to +40 °C
    c. Impendence: 50 Ω
    d. Chassis:
        1) Shall be of modular design capable of supporting 2'.: 32 Remote Units per 19", 4 RU chassis
        2) Shall support redundant power supplies
        3) Shall have the capability to remotely power the Remote Units via composite fiber-optic cable
    e. Automatic Gain Control (AGC): Shall provide AGC for optical loss compensation
    f. Optical Budget: Shall support:≤ 3 dB optical budget (-3 km or 2 miles)
    g. Auxiliary Channel: Shall provide an input to support 400 to 2700 MHz for future expandability
    h. Interlink: Shall support one fiber or two fibers bi-directional optical link for distances up to 20 km with a 10 dB optical budget
    i. Remote Supervision:
        1) Shall support the TCP/IP protocol, SNMPv2, FTP, HTTP, Telnet, and be fully compatible with general purpose SNMP managers
        2) Remote access shall be available via Point-to-Point Protocol (PPP), over circuit-switched/packet data and wired/wireless modems
        3) Each Active device shall be manageable via a Web GUI
        4) Auto Mapping: Each board position shall be automatically mapped during system turn-up
2. Frequency Bands Supported: 380 - 512 MHz LMR, 769 - 806 MHz LMR, 806 - 869 MHz LMR/SMR/ESMR, 896 - 941MHz LMR/SMR/ESMR, 824 - 894 MHz Cellular, 1710 - 1755 MHz AWS, 1900 - 1950 MHz PCS and 2496 - 2690 MHz BRS/EBS.
3. Approved Manufacturer In accordance with Section 1.3

L. Fiber-Optic Remote Units: The Fiber-Optic Remote Unit converts the RoF signal back to radio over coax, as well as provides filtering so that multiple frequency bands can reside over the same passive cable and antenna infrastructure.
1. Characteristics
    a. Operating Temperature Range: +5 °C to +40 °C
    b. Impendence: 50 Ω
    c. Power Consumption: ≤ 105 watts, maximum
    d. Output Power per Carrier at Antenna Port:

TechnoloJN/Band (MHz)	Single carrier (dBm
Analog700	27
GSM700	27
Analog 800 and 850	27
GSM 850 and 850	31

GSM 850 and 850 at band edges	29
iDEN 800 and 850	26
iDEN 800 and 850 at band edges	24
CDMA 800 and 850	29
CDMA 800 and 850 at band edges	27
Analog900	29
iDEN900	23
CDMA 1700	30
W-CDMA 1700	28
Analog 1900	31
GSM 1900	31
CDMA 1900	29
W-CDMA 1900	27

e. MTBF (excluding external power supply): 2: 160,000 hours

f. Physical: The Remote Unit shall consist of the following:

1) Ingress Protection: IP31 or equivalent
2) Frequency Bands supported: 769 - 806 MHz LMR, 806- 869 MHz LMR/SMR/ESMR, 896 - 941MHz LMR/SMR/ESMR, 824 - 894 MHz Cellular, 1710 - 1755 MHz AWS, 1850 - 1995 MHz PCS
3) Optical Port: 2xSC-APC connector (separated uplink/downlink)
4) Antenna Port: Single 50 n N type female connector
5) Auxiliary Ports: Two SMA female for future add-on modules

g. Uplink Noise Figure:

1) LMR 700, LMR 800, Cell850: ≤ 7.5 dB
2) LMR 700, LMR 800, Cell850 at band edges: ≤ 9 .5 dB
3) LMR 900: ≤ 8.5 dB
4) AWS: ≤ 7.5 dB
5) PCS 1900 extended: ≤ 7.5 dB

2. Approved Manufacturer In accordance with Section 1.3.

PART 3 EXECUTION

3.1 INSTALLATION

A. The contractor shall design, install, commission and test the DAS in accordance with the manufacturer's instructions and recommendations.

B. The contractor shall install the DAS in accordance with the accepted SOW.

3.2 ACCEPTANCE TESTING

A. Acceptance testing will be performed confirming the requirements of Section 1.7 have been met.

B. The contractor shall complete the acceptance testing as prescribed in the approved Acceptance Test Plan (ATP) submittal.

END OF SECTION

SECTION 280533 - RACEWAY AND BOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Raceway and Boxes for Electronic Safety and Security Systems.

B. Related Sections:
   1. Section 260400 – General Conditions for Electrical Trades.
   2. Section 260526 - Grounding and Bonding for Electrical Systems.
   3. Section 260533 - Raceway and Boxes for Electrical Systems.
   4. Section 260534 - Floor Boxes for Electrical Systems.
   5. Section 280553 - Identification for Electronic Safety and Security.

1.2 REFERENCES

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC);

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S);

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A);

D. NECA 1 - Standard for Good Workmanship in Electrical Construction;

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT);

F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit;

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC);

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable;

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit;

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit;

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing;

L. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT);

M. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

N. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

O. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

R. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

S. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

T. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

U. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

V. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

W. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

X. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

Y. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

Z. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

AA. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

BB. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

CC. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

1.3 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.

4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for all conduits and fittings outlined in Part 2.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

D. Shop Drawings:
1. Indicate proposed arrangement for conduits to be installed within or under structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

E. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs (where permitted), and conduits 2 inch trade size and larger.

F. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

G. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Division 01 – General Requirements.
2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

D. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

1.8 COORDINATION

A. See Division 01 – General Requirements

B. Coordinate installation of outlet boxes for equipment connected under Section 260503.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

D. Security contractor is responsible to fully coordinate with the site and concrete contractors and all other trades when routing conduit underslab. Routing of conduit underslab may be acceptable, provided spacing of conduits is adequate for proper backfilling of area surrounding conduits. Adequate spacing shall mean using factory made conduit spacers that allow for a minimum of 3-inches for backfilling with sand or 3 times the pipe diameter for backfilling with a structural fill. Proposed conduit routing, installation and methods and backfilling procedures shall be submitted to the Engineer for review prior to installation.

PART 2 PRODUCTS

2.1 Refer to Section 260533 – Raceway and Boxes for Electrical Systems. All Part 2 Product requirements listed in this Section shall apply to Division 28 Electronic Safety and Security.

PART 3 EXECUTION

3.1 Refer to Section 260533 – Raceway and Boxes for Electrical Systems. All Part 3 Execution requirements listed in this Section shall apply to Division 28 Electronic Safety and Security.

END OF SECTION

SECTION 280553 - IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Security system identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

1.2 RELATED REQUIREMENTS (follow the most currently adopted amended version)

A. See Division 01 – General Requirements

B. Division 09 - Finishes.

C. Section 260400 – General Conditions for Electrical Trades.

D. Section 260553 – Identification for Electrical Trades.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

C. NFPA 70 - National Electrical Code.

~~D.~~ NFPA 70E - Standard for Electrical Safety in the Workplace

E. UL 969 - Marking and Labeling Systems.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.8 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature and humidity is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 Refer to Section 260553 – Identification for Electrical Systems. All Part 2 Product requirements listed in this Section shall also apply to Division 28 Electronic Safety and Security.

PART 3 EXECUTION

3.1 Refer to Section 260553 – Identification for Electrical Systems. All Part 3 Execution requirements listed in this Section shall also apply to Division 28 Electronic Safety and Security, except where specified separately herein.

3.2 INSTALLATION – SECURITY SYSTEM LABELING

A. Label Installation:
   1. All labeling standards shall be confirmed with and approved by owner’s IT staff prior to performing work. It is the responsibility of the contractor to coordinate with owner’s staff.
   2. Labeling procedures shall meet TIA/EIA 568B Series standard and BICSI Standards and shall be pre-approved by the Owner.
   3. Permanently label, using pre-printed labels, all cables and terminations.
      a. Patch panels and cross-connect blocks, numerically from top to bottom.
      b. Patch panel port with work area outlet label.

c. Cable segments.

4. Install label parallel to equipment lines.
5. Use industry standard TIA/EIA and BISCI color codes.
6. Each work station outlet jack and corresponding patch panel port shall be marked with the same, unique label.
7. Mark the plate with standard nomenclature as required by the configuration. Mark the outlet plainly and neatly with its station identification, as indicated in above paragraph. The station identification shall also be marked inside the outlet plate on the backing plate of the outlet, and shall match the ID used at the patch panel port. Make the outlet marking using the Panduit system or equal, except for the inside marking which may be by indelible marker. Place exposed marking on outlet plates under a transparent window for protection. Label cable with permanent marker compliant with EIA/TIA 606, six (6) inches back from the termination at both ends.

B. Wire Label Installation:
1. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
2. Install labels at data outlets identifying patch panel and port designation as specified.

C. Conduit Marker Installation:
1. Install conduit marker for each conduit longer than 10 feet.
2. Conduit Marker Spacing: 20 feet on center.

END OF SECTION

SECTION 281300 - ACCESS CONTROL AND SURVEILLANCE

PART 1 GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections with DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

B. Attention is directed Section 260400 – GENERAL CONDITIONS FOR ELECTRICAL TRADES, which is hereby made a part of this Section of the Specification

1.2 SUMMARY

A. Owners Vendor (ADT) shall provide a modular and network-enabled access control system for security management. Equipment shall include card readers, access system controllers, security system controllers, security system field devices, interior and exterior cameras, recording equipment and software, and computer servers for a complete integrated security management system.

B. Project electrical contractor shall coordinate with ADT, and shall provide all required system power, conduit, wiring, and installation of components provided by ADT.

C. Related Sections
   1. Carefully examine all of the Contract Documents for requirements that affect the work of this section. Other specification sections that directly relate to the work of this section include, but are not limited to, the following:
      a. Division 08 – Door Hardware
      b. Section 280533 – Conduits and Backboxes for Electronic Safety and Security
      c. Section 280553 – Identification for Electronic Safety and Security
      d. Section 271000 – Structured Cabling (for Ethernet cabling requirements)

1.3 REFERENCES

A. Reference Standards: Provide systems which meet or exceed the requirements of the following publications and organizations as applicable to the Work of this Section:
   1. Underwriters Laboratories Inc. (UL):
      a. UL 365: Police Station Connected Burglar Alarm Units and Systems.
      b. UL 609: Local Burglar Alarm Units and Systems.
      c. UL 611: Central Station Burglar-Alarm Units.
      d. UL 636: Holdup Alarm Units and Systems.
      e. UL 684: Local, Central Station, and Remote Station.
      f. UL 1023: Household Burglar-Alarm System Units.
      g. UL 1076: Proprietary Burglar-Alarm Units and Systems.
      h. UL 1610: Central-Station Burglar-Alarm Units.
   2. Federal Communications Commission (FCC):
      a. Code of Federal Regulations Title 47: Part 15: Radio Frequency Devices.
      b. Code of Federal Regulations Title 47: Part 68: Connection of Terminal Equipment to the Telephone Network.

3. Consultative Committee for International Radio (CCIR)
4. Electronic Industry Association (EIA)
5. Joint Photographic Experts Group (JPEG)
6. Moving Pictures Experts Group (MPEG)
7. Motion Joint Photographic Experts Group (MJPEG)
8. National Television Systems Committee (NTSC)
9. Phase Alternating by Line (PAL)
10. Institute for Electrical and Electronics Engineers (IEEE)
11. Physical Security Interoperability Alliance (PSIA)
12. Open Network Video Interface Forum (ONVIF)
13. Real Time Streaming Protocol (RTSP)

B. Definitions
1. HD (High-definition) – refers to video having resolution substantially higher than traditional television systems. HD has one or two million pixels per frame.
2. CIF (Common Intermediate Format) – refers to a standard video format, which is categorized based on the resolution.
3. IR (Infrared) – refers to a visual range requiring little to no light to visualize.
4. IP (Internet Protocol) – refers to a device that operates over the building's network.
5. VMS (Video Management System) – The software that operates all video surveillance cameras.
6. NVR (Network Video Recorder) – Server that configures and stores recorded data from the cameras.
7. SMS (Security Management System) – The software that operates all access control devices.

1.4 SYSTEM DESCRIPTION

A. Integration: ADT is responsible for integrating the systems described in this section to form a complete, unified system. This includes integration with any potential existing global or enterprise systems indicated in drawings and within this specification section. All systems provided under this section shall be capable of being integrated with one another and communicating to one another.

B. Access Control:
1. The access control components of this system shall meet the requirements of business and government access control systems.
2. The system shall monitor and control facility access, and shall have the ability to perform alarm monitoring, camera and video monitoring (when integrated with a compatible integrated Video Monitoring System), communications loss monitoring, and temperature monitoring.
3. The system shall also maintain a database of system activity, personnel access control information, and system user passwords and user role permissions.
4. The system shall provide an output to an automatic voice dialer to send a programmable voice message to the Town 911 system on activation of any duress button.
5. The system shall be controlled from a web browser or from a computer on site.
6. The system shall provide control and access to users on Local Area Networks (LAN), Wide Area Networks (WAN), wireless networks, and the Internet.
7. The system shall provide email and/or text message alerts for all alarm conditions and threats.
8. The system shall have an available mobile client platform.

9. Access control head-end hardware shall be capable of supporting all access controlled doors indicated in drawings.

C. Video Entry/ Intercom:
1. The video entry system shall allow for communications between the unsecure side of a door and a central master station(s).
2. The system shall integrate with door hardware and access control components to allow for remote locking and unlocking of secured doors.

1.5 SUBMITTALS

A. Product Data: Provide details and technical specifications for each product indicated. Include physical dimensions, features, performance, electrical characteristics, ratings, software versions, and operating system details.

B. Shop Drawings: Include system line diagrams, equipment locations, installation details, and system integration plans.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types, quantities, and sizes.
3. Plans and Elevations: Dimensioned plans and elevations of equipment racks, enclosures, and conduit interconnections, including access and workspace requirements.
4. Data Calculations: Provide data bandwidth and storage calculations, including data backup and archive configuration details meeting the minimum project requirements as described herein.
5. Power and Heat Load Calculations: Provide power and heat load calculations for all hardware, including UPS capacity calculations.
6. Wiring Diagrams: For power and signal wiring.

C. Equipment and Software List: Include every piece of equipment and software by product/model name and/or number, manufacturer, serial number, revision number, location, and date of original installation. If factory and/or bench testing regimens are required by the project plan, add pretesting record of each piece of equipment and software, listing name of person testing, date of test, and adjustments made.

D. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, customized to the system installed. Include system and operator manuals.

E. Field Tests: Submit results of field testing of every device including date, testing personnel, retesting date if applicable, and confirmation that every device passed field testing.

F. Maintenance Service Agreement: Submit a sample copy of the manufacturer's maintenance service agreement, including cost and services for a one year period for Owner's review. Maintenance shall include, but not be limited to; labor and materials to repair the system; provide test and adjustments, and regular inspections.

1.6 CLOSEOUT SUBMITTALS

A. Division 01 – Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of all equipment.

C. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.

1.7 QUALIFICATIONS

A. All work, equipment, materials, construction, and installation provided under the Contract shall comply with the current applicable rules, regulations, standards, and ordinances of the local Authorities Having Jurisdiction (AHJ).

B. Electrical Components, Devices, Accessories, and Installation shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   1. Comply with NECA 1.
   2. Comply with NFPA 70.

C. Manufacturer: Minimum five years' experience in manufacturing and maintaining IP-based security systems. Manufacturer shall provide toll-free technical assistance and support available 24/7.

D. System integrators shall have a minimum of five years' experience in installing IP-based security systems, and shall be certified installers of all security equipment specified herein, and on the drawings.

1.8 MAINTENANCE SERVICE

A. Division 01: Execution and Closeout Requirements: Maintenance service.

B. Furnish service and maintenance of intrusion detection system for two years from Date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Division 01: Spare parts and maintenance products.

1.10 PRE-INSTALLATION MEETINGS

A. Division 01: Administrative Requirements: Pre-installation meeting.

B. Convene minimum three weeks prior to commencing work of this section. DELIVERY, STORAGE AND HANDLING

C. Deliver materials and product in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.11 COORDINATION

A. Coordinate the installation of cable and equipment with other construction activities and the work of other sections.

1.12 WARRANTY

A. Contractor's Warranty: Warranty the installation to be free of defect for a period of two (2) years from date of acceptance by commissioning agent.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. System components shall be submitted directly to Owner, via ADT.

B. All products submitted shall be capable of integration with one another.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine cable pathways including conduit, raceways, cable trays, and other pathway elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine rough-in for control cable and conduit systems to controllers, card readers, and other security system components to verify conduit and back-box locations prior to installation of security devices

C. Examine available network capacity and support infrastructure. Consult with network administrator for compliance with network standards and capacity.

D. Examine install location for compliance with space allocations, installation tolerance, hazards to safe system operation, and other conditions affecting installation.

E. Examine roughing-in for LAN, WAN, and IP network before device installation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with ANSI/TIA-606-B Labelling Standard.

B. In meetings with Architect and Owner, present Project Planning documents and review, adjust, and prepare final programming and configuration documents. Use final documents to program and configure security system software.

3.3 INSTALLATION

A. Ground all security system components and cabling in accordance with Section 260529 – Grounding and Bonding.

B. Label all security system components and cabling in accordance with Section 280553 – Identification for Electronic Safety and Security.

C. Provide all required backboxes and pathways for security system components and cabling in accordance with Section 280533 – Conduits and Backboxes for Electronic Safety and Security.

D. Rated Stairs: Penetrations into stairs are NOT permitted except for items serving that stair.

E. Make all connections to built-in door wiring in junction boxes.

F. Test all components before shipping to the project location.

G. Access control system shall be installed, programmed, and tested in accordance with manufacturer's installation instructions.
   1. Coordinate interfaces with Owner's representative where appropriate.
   2. Provide backboxes, racks, connectors, supports, conduit, cable, and wire for a complete and reliable installation. Obtain Owner's approval for exact location of all boxes, conduit, and wiring runs prior to installation.
   3. Install conduit, cable, and wire parallel and square with building lines, including raised floors areas. Do not exceed forty percent fill in conduits. Gather wires and tie to create an orderly installation.
   4. Coordinate with other trades to provide proper sequencing of installation.

H. Supervise installation to appraise ongoing progress of other trades and contracts, make allowances for all ongoing work, and coordinate the requirements of the installation of the Security Management System.

I. Coordinate wiring pathway and conduit requirements through doors and frames with Division 8.

J. Division 8 to provide all electrified hardware including, but not limited to: electric locks, electrified panic hardware, electrified door closers, transfer hinges; and power transfer devices. Wiring of devices by Division 28.

K. Coordinate door and frame prep requirements for magnetic door contacts and request-to-exit devices supplied by Division 28 with Division 8.

L. Comply with TIA 569-C, "Commercial Building Standard for Telecommunications Pathways and Spaces."

M. Card Readers and Keypads and Peripheral Devices:
   1. Install number of conductor pairs recommended by device manufacturer for the functions specified.
   2. Follow device manufacturer's installation requirements for maximum cable distances and sizes.

3.4 FIELD COMMISSIONING AND CERTIFICATION

A. Field Commissioning: ADT to test system as recommended by manufacturer, including the following:
   1. Conduct complete inspection and testing of equipment, including verification of operation with connected equipment.
   2. Test devices and demonstrate operational features for Owner's representative and authorities having jurisdiction as applicable.

3. Correct deficiencies until satisfactory results are obtained.
4. Submit written copies of test results.

B. Tests and Inspections:
1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA 568-C, "Commercial Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA 568-C.
2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

C. The Integrator (ADT)shall demonstrate the functionality of the security system upon completion of installation, documenting the result of all tests and providing these results to the Owner.
1. The security system shall be tested in accordance with the following:
   a. The Integrator shall be responsible for documenting and entering the initial database into the system debugging all issues. Prior to full operation, a complete demonstration of the computer real-time functions shall be performed. A printed validation log shall be provided as proof of operation for each software application package. In addition, a point utilization report shall be furnished listing each point.
   b. Upon satisfactory on-line operation of the system software, the entire installation including all subsystems shall be field inspected. Each device shall be tested as a working component of the completed system. All system controls shall be inspected for proper operation and response.
   c. Tests shall demonstrate the response time and display format of each different type of input sensor and output control device. Response time shall be measured and documented with the system functioning at full capacity. Computer operation shall be tested with the complete data file.
   d. The Integrator shall maintain a complete log of all inspections and tests. Upon final completion of system tests, a copy of the log records shall be submitted as part of the as-built manuals along with a letter of certification to indicate that the tests have been performed, and all devices are operational.
   e. The completed system shall be tested in front of the owner or owner’s agent. The system test shall be witnessed by the Authority Having Jurisdiction if necessary. Any deficiencies noted during the testing must be corrected.

3.5 TRAINING:

A. The Owner may assign personnel to participate with the contractor during installation. Without delaying the work, familiarize the Owner's personnel with the installation, equipment, and maintenance.

B. Provide training to personnel selected by the Owner on operation and basic maintenance of all systems and equipment.

C. Include 8 hours of training Owner’s staff.

END OF SECTION

SECTION 283100 - FIRE DETECTION AND ALARM SYSTEM

ENGINEERING SPECIFICATION
INTELLIGENT REPORTING FIRE DETECTION SYSTEM

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 13800 - Building Automation and Control.

B. Section 13900 (21 00 00) - Fire Suppression.

1.2 DESCRIPTION

A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall include provisions for the system operator to override automatic messages system wide or in selected zones.

C. The system shall be support additional, alternate Fire Command Centers, which shall be capable of simultaneous monitoring of all system events. Alternate Fire Command Centers shall also support an approved method of transferring the control functions to an alternate Fire Command Center when necessary. All Fire Command Centers shall be individually capable of assuming Audio Command functions such as Emergency Paging, audio zone control functions, and Firefighter's Telephone communication functions.

D. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

E. The fire alarm system shall be manufactured by an ISO 9001:2008 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994

F. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It’s acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.

G. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

H. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.3 GUARANTY:

A. The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer's warranty of a minimum of 3 years.

1.4 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (5) years Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

C. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

1.5 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. National Fire Protection Association (NFPA) - USA:

No. 12	Extinguishing Systems (low and high)
No. 12A	Halon 1301 Extinguishing Systems
No. 13	Sprinkler Systems
No. 15	Water Spray Systems
No. 16	Foam / Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
No. 2001	Clean Agent Extinguishing Systems
No. 70	National Electric Code
No. 90A	Air Conditioning Systems
No. 92A	Smoke Control Systems
No. 92B	Smoke Management Systems in Malls, Atria, Large Areas
No. 72	National Fire Alarm Code
No. 101	Life Safety Code

C. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 2572	Mass Notification Systems
No. 217	Smoke Detectors, Single and Multiple Station
No. 228	Door Closers - Holders for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems

No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 1481	Power Supplies for Fire Protective Signaling Systems
No. 346	Waterflow Indicators for Fire Protective Signaling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances
No. 2017	Standard for General-Purpose Signaling Devices and Systems
No.60950	Safety of Information Technology Equipment

D. Local and State Building Codes.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1.6 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL	Underwriters Laboratories, Inc
ULC	Underwriters Laboratories Canada
FM	Factory Mutual
NYFD	New York Fire Department
CSFM	California State Fire Marshal

B. The system shall be approved for use in Marine applications by the following agencies.

1. United States Coast Guard
2. Lloyd's Register
3. American Bureau of Shipping

C. The system shall be certified for seismic applications in accordance with the International Building Code (IBC). For OSHPD applications in California the system shall be Pre-Approved for seismic applications. The basis for qualification of seismic approval shall be via shake table testing.

PART 2.0 PRODUCTS

2.1 Main Fire Alarm Control Panel or Network Node:

A. Main FACP or network node shall be a NOTIFIER Model NFS2-640 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

2.2 System Capacity and General Operation

A. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

B. Each network node shall provide, or be capable of 318 intelligent / addressable devices per SLC loop.The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.

C. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire and gas detection system.

D. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.

E. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes.

F. The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.

G. The FACP or each network node shall provide the following features:

1. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
2. Detector sensitivity test, meeting requirements of NFPA 72.
3. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
4. Up to nine sensitivity levels for alarm, selected by detector. The alarm level range shall be 0.5 to 2.35 percent per foot for photoelectric detectors, 0.5 to 2.5 percent per foot for ionization detectors,, 0.5 to 4.0 percent per foot for acclimate detectors and 1.0 to 4.0 percent per foot for multi-criteria (IntelliQuad and IntelliQuad PLUS) detectors The system shall also support sensitive advanced detection laser detectors with an alarm level range of .02 percent per foot to 2.0 percent per foot. The system shall also include up to nine levels of Pre-alarm, selected by detector, to indicate impending alarms to maintenance personnel.
5. The ability to display or print system reports.
6. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
7. PAS presignal, meeting NFPA 72 requirements.
8. Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.
9. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
10. Control-by-time for non-fire operations, with holiday schedules.
11. Day/night automatic adjustment of detector sensitivity.
12. Device blink control for sleeping areas.
13. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Panel notification circuits (NAC 1,2,3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer. The panel shall also provide a

coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."

14. Network Communication
15. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download, and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in compliance with the NFPA 72 requirements for testing after system modification.

    a. This utility shall provide the ability to create and print NFPA style Test and Inspection reports
    b. This utility shall provide the ability to create and print Device Maintenence information

16. The 80-character display keypad shall be an easy to use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
17. When configured with an optional 640-character display the display shall use 10 "soft" keys for screen navigation or to accomplish dedicated programming functions. Full programming access shall require use of a laptop and the proper programming utility. With the 640 display option the system shall support distributed audio amplifiers on the digital audio loop of the Digital Voice Command.

H. Signaling Line Circuits (SLC)

1. Each FACP or FACP network node shall support up to two SLCs. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (onization, photoelectric, multi-criteria, thermal, laser, fire/CO) and 159 intelligent modules (monitor, control, relay, releasing) for a loop capacity of 318 devices. The addition of the optional second loop shall double the device capacity, supporting a total of 636 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

I. Serial Interfaces

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.

    a. EIA-232 interface shall be used to connect an UL-Listed 40 or 80 column printer. Printers that are not UL-Listed are not considered acceptable substitutes.
    b. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.
    c. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

J. Digital Voice Command Center

1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset. The DVC shall support up to 8 channels of voice when configured with Digital Audio Amplifiers and 4 channels of voice when employing the optional analog output card. Each DVC shall support up to 32 digital audio amplifiers.
2. Function: The Voice Command Center equipment shall perform the following functions:

    a. Operate as a supervised multi-channel emergency voice communication system.
    b. Operate as a two-way emergency telephone system control center. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
    c. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
    d. Provide all-call Emergency Paging activities through activation of a single control switch.
    e. As required, provide vectored paging control to specific audio zones via dedicated control switches.
    f. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
    g. Provide a software utility capable of off-line programming for the DVCoperation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.
    h. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.
    i. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
    j. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

3. The emergency voice alarm communication system shall incorporate a Two-way emergency telephone communication system.

    a. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
    b. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Digital Voice Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
    c. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.

J. Remote Microphone Station

1. Provide remote microphone station for Gymnasium, and Multi-Purpose room for emergency instructions in Assembly Spaces.

K. Audio Amplifiers

1. The Audio Amplifiers will provide Audio Power (@25 Volt RMS or 70 RMS) for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:

    a. Earth Fault on DAP A (Digital Audio Port A)
    b. Earth Fault on DAP B (Digital Audio Port B)
    c. Audio Amplifier Failure Detected Trouble
    d. Active Alarm Bus input
    e. Audio Detected on Aux Input A
    f. Audio Detected on Aux Input B
    g. Audio Detected on Firefighter's Telephone Riser
    h. Receiving Audio from digital audio riser
    i. Short circuit on speaker circuit 1
    j. Short circuit on speaker circuit 2
    k. Short circuit on speaker circuit 3
    l. Short circuit on speaker circuit 4
    m. Data Transmitted on DAP A
    n. Data Received on DAP A
    o. Data Transmitted on DAP B
    p. Data Received on DAP B
    q. Board failure
    r. Active fiber optic media connection on port A (fiber optic media applications)
    s. Active fiber optic media connection on port B (fiber optic media applications)
    t. Power supply Earth Fault
    u. Power supply 5V present
    v. Power supply conditions - Brownout, High Battery, Low Battery, Charger Trouble

4. The audio amplifier shall provide the following built-in controls:

    a. Amplifier Address Selection Switches
    b. Signal Silence of communication loss annunciation Reset
    c. Level adjustment for background music
    d. Enable/Disable for Earth Fault detection on DAP A
    e. Enable/Disable for Earth Fault detection on DAP A
    f. Switch for 2-wire/4-wire FFT riser

5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
6. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
7. System shall be capable of backing up digital amplifiers.
8. One-to-one backup shall be provided by either a plug-in amplifier card or a designated backup amplifier of identical model as the primary amplifier.
9. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
10. Multi-channel operation from a single amplifier shall be supported by the addition of an

optional plug-in amplifier card.

L. Audio Message Generator (Prerecorded Voice)/Speaker Control:

1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. System paging from emergency telephone circuits shall be supported.
5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:
   a. Lamp Test
   b. Trouble
   c. Off-Line Trouble
   d. Microphone Trouble
   e. Phone Trouble
   f. Busy/Wait
   g. Page Inhibited
   h. Pre/Post Announcement Tone

M. Controls with associated LED Indicators:

1. Speaker Switches/Indicators

   a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
   b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.

2. Emergency Two-Way Telephone Control Switches/Indicators

   a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
   b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

N. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. Point Disable: Any addressable device in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:

a. Device status
b. Device type
c. Custom device label
d. View analog detector values
e. Device zone assignments

5. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
7. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
8. Software Zones: The FACP shall support 142 independent programmable software zones
9. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:

    a. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
    b. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
    c. All devices tested in walk test shall be recorded in the history buffer.

10. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.

11. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.

R. Portable Emergency Telephone Handset Jack

1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on the plans. Jacks shall be approved for emergency telephone system application.
2. Insertion of a portable handset plug into a jack shall send a signal to the fire command

center, which shall audibly and visually indicate the on-line condition, and shall sound a "ring" indication in the handset.

3. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

S. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled as "Emergency Telephone." The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection so that lifting the handset off of the cradle shall send a signal to the fire command center, which shall audibly and visually indicate its on-line (off-hook) condition.
3. On activating the remote phone, the phone earpiece shall sound a telephone ring signal until the master handset is lifted.
4. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

T. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

U. Communicators

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.

The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID. Communication shall include vital system status such as:

a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
b. Independent Addressable Device Status
c. AC (Mains) Power Loss
d. Low Battery and Earth Fault
e. System Off Normal
f. 12 and 24 Hour Test Signal
g. Abnormal Test Signal (per UL requirements)
h. EIA-485 Communications Failure
i. Phone Line Failure

3. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
4. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.
5. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.

6. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

V. Smoke Control Annunciator

1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B operation to allow for future use and system expansion.
2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
4. All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.

5. It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.

2.3 Gateway & Webserver Options

A. Common Alerting Protocol (CAP) Gateway: The system shall support an optional CAP Gateway (Common Alerting Protocol). The CAP Gateway translates fire system messages to industry standard CAP messages for integration with CAP-compliant clients. A CAP gateway shall be available from the fire alarm control panel manufacturer.

B. LEDSIGN Gateway: The system shall support an optional and proprietary LEDSIGN Gateway to interface to LED signs that will automatically display emergency messages. The signs shall be capable of storing up to 100 messages that can be activated via system programming with the ability to be manually overridden. The Sign Gateway shall support up to 10 independent signs, each sign capable of playing an independent message. Multiple LEDSIGN Gateways can be used in network applications. An LEDSIGN gateway shall be available from the fire alarm control panel manufacturer.

C. BACnet Interface Gateway: The system shall be capable of being interfaced with BACNet compliant clients. A BACnet interface supporting BACnet/IP communication shall be available from the fire alarm control panel manufacturer.

D. MODbus Interface Gateway: The system shall be capable of being interfaced with MODbus compliant clients. A MODbus interface supporting MODbus/TCP communication shall be available from the fire alarm control panel manufacturer.

E. Noti-Fire-Net Gateway: The system shall support an IP based gateway to enable the panel or local Noti-Fire-Net to be connected to an ONYXWorks workstation via the Internet or Intranet. This gateway shall also support the ability to integrate the system to an interactive firefighter's display. The Noti-Fire-Net Gateway shall be available from the fire alarm control manufacturer.

F. Webserver: The system shall support a webserver allowing remote connection via the Internet or Intranet. Authorized users will have the ability to view panel/network history, event status and device properties. The webserver shall also support sending event information via email or text to up to 50 registered users, the webserver shall be available from the fire alarm control panel manufacturer.

G. Web Portal Interface: The system shall be capable of being interfaced with a web portal to integrate with Inspection and Service Manager utilities. The web portal and inspection and service manager utilities shall be available from the fire alarm control panel manufacturer.

2.4 System Components - Addressable Devices

A. Addressable Devices - General

1. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
2. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
11. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
12. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
13. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status;NOTIFIER model # NBG-12LX. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall be NOTIFIER model # FSP-851 and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent VIEW® Laser Photo Smoke Detector: The intelligent laser photo smoke detector shall be a spot type detector, NOTIFIER model # FSL-751, that incorporates an extremely bright laser diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor.

1. The laser detector shall have conductive plastic so that dust accumulation is reduced significantly.
2. The intelligent laser photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.02 percent per foot.
3. The laser detector shall not require expensive conduit, special fittings or PVC pipe.
4. The intelligent laser photo detector shall support standard, relay, isolator and sounder detector bases.
5. The laser photo detector shall not require other cleaning requirements than those listed in NFPA 72. Replacement, refurbishment or specialized cleaning of the detector head shall not be required.
6. The laser photo detector shall include two bicolor LEDs that flash green in normal operation and turn on steady red in alarm.

E. Intelligent Ionization Smoke Detector: The intelligent ionization smoke detector shall be NOTIFIER model # FSI-851 and shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

F. Intelligent Multi Criteria Acclimating Detector: The intelligent multi-criteria Acclimate® Plus™

detector shall be an addressable device, NOTIFIER model # FAPT-851, that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.

1. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
2. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

G. Intelligent Thermal Detectors: The intelligent thermal detectors shall be NOTIFIER FST- series addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

H. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely. The Intelligent Duct Detector housing shall be model # DNR(W) and the remote test capable photoelectric smoke detector shall be NOTIFIER model # FSP-851R.

I. IntelliQuad™ Advanced Multi-Criteria Intelligent Detector

1. Intelligent multi-criteria fire detector shall be a NOTIFIER model number FSC-851. Smoke detector shall be an addressable intelligent multi-criteria smoke detector. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical carbon monoxide (CO) sensor, a daylight-filtered infrared sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.
2. The intelligent multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in an effort to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The product design shall be capable of selecting the appropriate sensitivity levels based on the environment type chosen by user in which it is installed (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes.
3. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The

device shall provide unique signals to indicate when 20% of the drift range is remaining, when 100% of drift range is used, and when there is a chamber fault to show unit requires maintenance.

4. The detector shall indicate CO trouble conditions including 6 months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
5. The detectors shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detectors shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 99 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.
6. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There are three test methods: functional magnet, smoke entry aerosol, or direct heat method.
7. The detectors shall provide two LEDs to provide 360° visibility. The LEDs are placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED, sounder base, and / or relay base (optional accessories). The external remote alarm can be interconnected to other sounder or relay bases for activating all devices in a space via a single alarming unit.
8. Two LEDs on the sensor are controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, can cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
9. The detectors shall be ceiling-mount and shall be plug-in mounted into a twist-lock base. These detectors shall be constructed of off-white UV resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. Mounting base shall be mounted on junction box which is at least 1.5 inches (3.81 cm) deep. Mounting base shall be available to mount to standard junction boxes. Suitable boxes include:

    a. 4.0" (10.16 cm) square box with and without plaster ring.
    b. 4.0" (10.16 cm) octagonal box.
    c. 3.5" (8.89 cm) octagonal box.
    d. Single-gang box.

10. Meets Agency Standards

    a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
    b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
    c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling

J. IntelliQuad™ PLUS Advanced Multi-Criteria Intelligent Fire/CO Detector

1. Advanced Multi-Criteria Fire/CO detector shall be NOTIFIER model # FCO-851 and shall be an addressable advanced multi-criteria smoke detector with a separate signal for carbon monoxide (CO) detection per UL 2075 standards.

2. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical CO sensor, a daylight-filtered infrared (IR) sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.

3. The advanced multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in order to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The detector shall be capable of selecting the appropriate sensitivity levels based on the environment type (office, manufacturing, kitchen, etc.) in which it is installed, and then have the ability to automatically change the setting as the environment changes.

4. The CO detector component shall be capable of a functional gas test using a canned test agent to test the functionality of the CO sensing cell.
5. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20 percent of the drift range is remaining, when 100 percent of drift range is used, and when there is a chamber fault to show the unit requires maintenance.
6. The detector shall indicate CO trouble conditions, including six months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
7. The detector shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detector shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 159 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.
8. The detector shall provide a test means whereby it will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There shall be four test methods: functional magnet, smoke entry aerosol, carbon monoxide aerosol or direct heat method.
9. The detector shall provide two LEDs to provide 360° visibility. The LEDs shall be placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED. The detector must be capable of connecting to a sounder base that provides both temporal 3 and temporal 4 patterns for fire and CO alarm.
10. Two LEDs on the sensor shall be controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, shall cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
11. The detector shall be plug-in mounted into a twist-lock base. The detector shall be constructed of off-white, UV-resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. The mounting base shall be mounted on a junction box that is at least 1.5 inches (3.81 cm) deep. The mounting base shall be available to mount to standard junction boxes. Suitable boxes include:

a. 4.0" (10.16 cm) square box with and without plaster ring.
b. 4.0" (10.16 cm) octagonal box.
c. 3.5" (8.89 cm) octagonal box.
d. Single-gang box.
e. Double-gang box

12. Meets Agency Standards

a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling
d. UL 2075 – Gas and Vapor Detector and Sensors – Systems Connected

L. Intelligent Addressable Reflected Beam Detector

1. The intelligent single-ended reflected beam smoke detector shall connect with two wires to the fire alarm control panel signaling line circuit (SLC). The detectors shall consist of a transmitter/receiver unit and a reflector and shall send data to the panel representing the analog level of smoke density. The detector shall be capable of being tested remotely via a keyswitch; NOTIFIER model # FSB-200. Model # FSB-200S shall be equipped with an integral sensitivity test feature

M. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. The addressable monitor module shall be NOTIFIER model # FMM-1 (Class A or B) or FMM-101 (Class B)
2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits; NOTIFIER model # XP10-M.

N. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device); NOTIFIER model # FZM-1.
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits; NOTIFIER model # XP6-MA

O. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered,

polarized audio/visual notification appliances; NOTIFIER model # FCM-1

2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;
3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.
4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits; NOTIFIER model # XP6-C.

P. Addressable Releasing Control Module

1. An addressable FlashScan releasing module shall be available to supervise and control compatible releasing agent solenoids; NOTIFIER model # FCM-1-REL.
2. The module shall operate on a redundant protocol for added protection.
3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.

Q. Addressable Relay Module:

1. Addressable Relay Modules shall be available for HVAC control and other network building functions; NOTIFIER model # FRM-1.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays; NOTIFIER model # XP6-R.

R. Addressable Two-In / Two-Out Monitor/Relay Module:

1. An addressable Two-In / Two-Out module shall be available; NOTIFIER model # FDRM-1.
2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

S. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building; NOTIFIER model # ISO-X.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

T. Smoke Control Annunciator

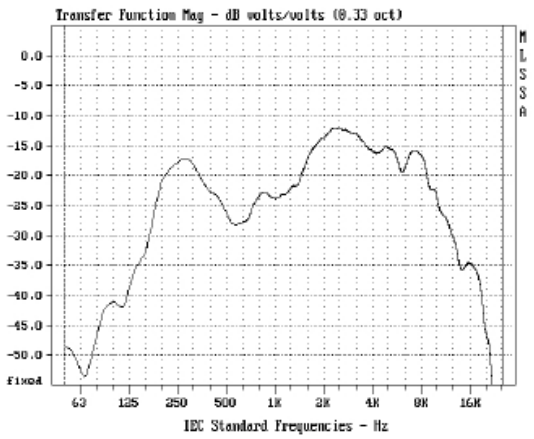
1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B operation to allow for future use and system expansion.
2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
4. All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.
5. It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.

U. SpectrAlert Advance Speakers

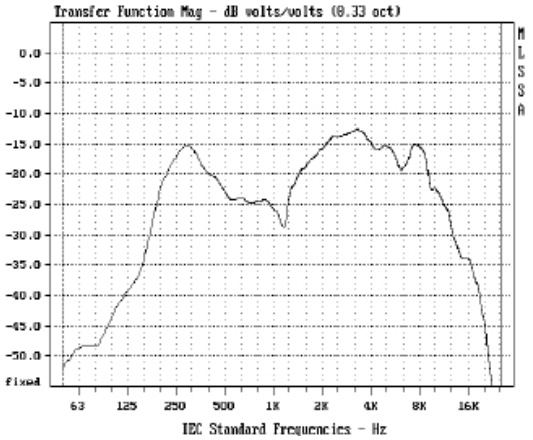
1. The Speaker appliance shall be System Sensor SpectrAlert Advance model _____ Speaker. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
5. All notification appliances shall be backward compatible.

Ceiling Speaker **Wall Speaker**

Wide Band Frequency Response



Wide Band Frequency Response

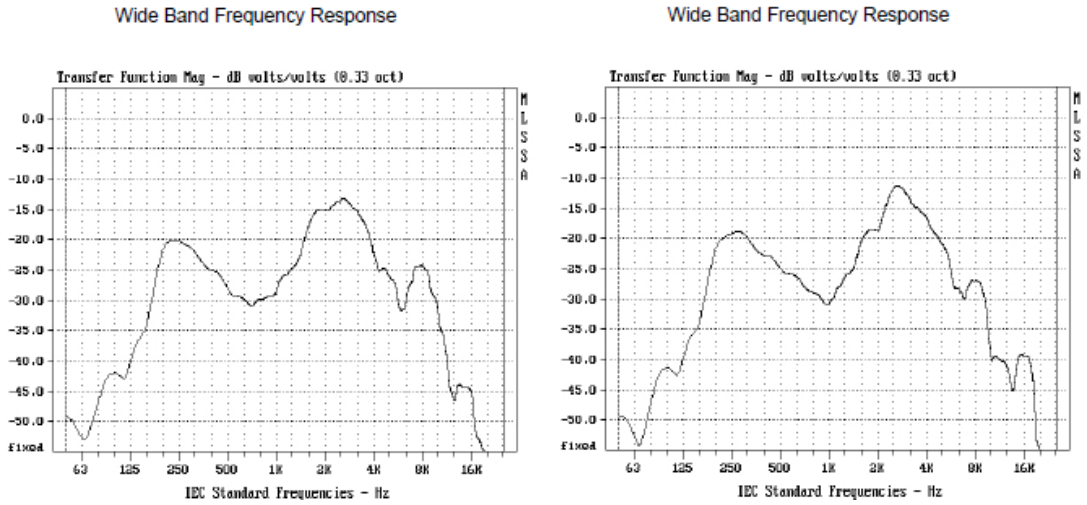


Note: The wide band frequency response is derived using MLS methods

V. SpectrAlert Advance Speaker Strobes

1. The Speaker Strobe appliance shall be System Sensor SpectrAlert Advance model _____ Speaker Strobe. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate. Also, SpectrAlert Advance speaker strobes and the Sync•Circuit™ Module MDL3 accessory, if used, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts (includes fire alarm panels with built in sync). When used with the Sync•Circuit Module MDL3, 12-volt rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt rated notification appliance circuit outputs shall operate between 16.5 to 33 volts. If the notification appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.
3. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall isolate speaker components to reduce ground fault incidents.
4. The speaker strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.
5. All notification appliances shall be backward compatible.

Ceiling Speaker Strobe **Wall Speaker Strobe**



Note: The wide band frequency response is derived using MLS methods

6. Strobe lights shall meet the requirements of the ADA, UL Standard 1971and be fully synchronized.

PART 3.0 - EXECUTION

3.1. INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2. TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

C. Verify activation of all waterflow switches.

D. Open initiating device circuits and verify that the trouble signal actuates.

E. Open and short signaling line circuits and verify that the trouble signal actuates.

F. Open and short notification appliance circuits and verify that trouble signal actuates.

G. Ground all circuits and verify response of trouble signals.

H. Check presence and audibility of tone at all alarm notification devices.

I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3. FINAL INSPECTION:

A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION:

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION

SECTION 281300.1 – SECURITY ACCESS VIDEO (ADT)

In accordance with the drawings, the Security Alarm, Access Control & Video Surveillance systems shall be carefully furnished and installed by the City's esteemed vendor, ADT Commercial, under the guidance of the NASPO contract's terms and conditions. In the event of any discrepancy, the NASPO contract's terms and conditions shall take precedence and be upheld.

All necessary work is explicitly detailed in the drawings, with all other trades pertaining to door hardware and electrical work required to coordinate seamlessly with the ADT Commercials design team.

The electrical contractor shall furnish and install all conduits, pull strings, backboxes, wire troughs, and all other essential materials in compliance with the drawings, applicable codes, and standards. This includes both interior and exterior card readers, security contacts, transfer hinges (backboxes), and camera locations.

The door hardware contractor shall work in conjunction with ADT Commercial to install all access-controlled doors as indicated on the drawings. The door hardware contractor must provide and accommodate all access-controlled doors with AD 300 series cylindrical locks with Von Duprin EPT 10 Transfer Hinges. Before the equipment is purchased and supplied, the door contractor must provide a door schedule highlighting all electronic access-controlled doors, indicating the physical handling, RH or LH and styles for approval by ADT Commercial.

General contractor is responsible to provide a full operation system with access hardware to all the doors in addition to access controls.

Direct Contact:
Gino Ezzo
Sr Account Executive
10761 Marks Way, Miramar, FL 330253976
M: 561.696.6075 E: GinoEzzo@adt.com
www.adt.com/commercial

END OF SECTION

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this Section.

B. General Notes and Specifications, including Clearing and Demolition notes as indicated on the Drawings.

1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the clearing work, as indicated on the drawings.

B. The CONTRACTOR shall do all clearing, grubbing, root-raking, and necessary clean-up operations in connection with the construction of the work and its related site work.

C. The work shall consist of the removal and disposal of trees, stumps, roots, limbs, brush, fences, asphalt, concrete street markers, etc. from all project areas as designated on the drawings.

D. The CONTRACTOR shall remove all refuse, asphalt pavement, concrete pavement, glass, metal, stone, plaster, lumber, paper materials, and any and all trash found in clearing and adjacent areas as directed by the Owner.

E. The CONTRACTOR shall furnish all services, labor, transportation, materials, and equipment necessary for the performance of these operations. All clearing and cleanup operations shall be accomplished to the complete satisfaction of the Owner.

1.3 RELATED WORK

A. Section 312200 – SITE GRADING.

1.4 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

1.5 SUBMITTALS

A. Owner or its representative may at its sole discretion waive these requirements. The work plans and method statements shall be detailed descriptions and drawings of the technical aspects of construction and accompanied by diagrams showing the construction activities

B. Submit a Disposal Plan in accordance with Contract Documents for Project record. The Disposal Plan may be included in the Construction Method Report for Site Work or as a separate document. Submit the Disposal Plan for Engineer review and comment within 10 Days after Effective Date and at least (15) days prior to the commencement of the relevant activities. Critical construction activities shall be identified and described including points in the process where Engineer review and comment are required before proceeding. The plan shall include but not be limited to details of the following:

1. A pre-condition survey to establish a topographic map of existing grades and preparation of a post-condition map showing final estimated grades of the completed disposal areas.
2. Estimated quantities of excavated materials for onsite and offsite disposal, the material type(s) and source(s), and the respective locations for disposal. Account for any uncertainties related to actual disposal quantities and demonstrate how the Contractor plans to progressively build the disposal fills.
3. Plan and equipment intended for use in placement of excavated materials, in fills and disposal of excavated materials.
4. Proposed haul routes, offsite disposal facilities, and estimated frequency and duration of offsite haulage.
5. A schedule, linked to the overall construction schedule, showing how placement of excavated materials in designated disposal areas will be managed.

C. The designs shall be included in the Detailed Design Report for Site Work and shall include but not be limited to the following:

1. Limits, locations, and details of the work pad.
2. Design computations, drawings and specifications for foundation preparation, fill placement, compaction and testing.
3. Submit complete product data including brand name, product number, chemical composition, material data sheets, and a complete set of manufacturer recommendations for use for all products and materials used in

1.6 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

B. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

C. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

D. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as directed.

E. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

F. Do not commence site clearing operations until temporary erosion and sedimentation control and plant-protection measures are in place.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion and sedimentation control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 PROTECTION AND CARE OF EXISTING TREES AND PALMS TO REMAIN

A. Watering

1. In areas where there is existing irrigation, it shall remain operable to the greatest extent possible during relocation procedures.

2. In areas where there is existing irrigation, all on-site trees to remain shall be supplied with temporary irrigation to remain operable until permanent irrigation is operable. Existing irrigation system to be demolished may be utilized as the temporary irrigation system.

B. Barricading

1. Barricade all existing trees and palms with 4’ high Staked ‘Orange’ Polyethylene Tensile plastic fencing or other barricade approved by CONSULTANT.

2. Barricades shall be installed outside the tree drip line/edge of tree canopy prior to any construction activity as depicted on the Drawings and within these Specifications.

3.4 EXISTING UTILITIES

A. Ensure proper safety and workmanship when working in the vicinity of existing utility lines, including proper clearance.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

C. Arrange with utility companies to shut off indicated utilities prior to commencement of work.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless previously coordinated within 48 hours. Temporary utility services may be required as determined by the Owner and schedule.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

B. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 24 inches below exposed subgrade in proposed roadway areas and original subgrade elsewhere.

C. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

D. Place fill material in horizontal layers not exceeding a loose depth of 8-inches, and compact each layer to a density equal to adjacent original ground.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

C. If hazardous materials are found, the contractor shall notify the Owner immediately.

D. If hazardous materials are encountered during demolition operations, the CONTRACTOR shall comply with applicable regulations, laws, and ordinances concerning removal, handling, transport and protection against exposure or environmental pollution.

3.9 CLEANUP AND REPAIR:

A. Upon completion of demolition work, the CONTRACTOR shall remove tools, equipment and demolished materials from site.

B. The CONTRACTOR shall repair demolition performed in excess of that required and return structures and surfaces to conditions existing prior to commencement of demolition work. The CONTRACTOR shall repair adjacent construction or surfaces soiled or damaged by demolition work.

END OF SECTION 311000

SECTION 311300 – SELECTIVE TREE & SHRUB REMOVAL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Removal work as required on drawings and as specified in this section and repair of damage to existing facilities to remain.

B. Related Sections:

1. 312000 – Earth Moving.
2. 320190.23 – Tree & Shrub Preservation.

1.02 SUBMITTALS

B. Removal Procedure for Site Work:

1. Procedure shall provide:
   a. Means for safe conduct of work, careful removal, and disposition of materials specified to be salvaged for the Owner.
   b. Protection of property to remain undisturbed.
   c. Timely disconnection of utility services.
2. Procedure shall include a detailed description of methods and equipment to be used for each operation, and sequence of each operation.

1.03 PROJECT/SITE CONDITIONS

A. Existing sidewalks, curbs, paving, landscaping, or other existing work not specified for removal that is temporarily removed, damaged, exposed, or disturbed or altered by removal work shall be repaired, patched, or replaced at no cost to the Owner.

B. Existing Trees:

1. Do not damage trees within project site specified to be left in place.
2. Protect trees indicated to remain as required with acceptable barricades or temporary fencing during construction.

C. Environmental Protection:

1. Dust Control:
   a. Control dust resulting from demolition to prevent spread of dust to occupied portions of buildings and to avoid creation of a nuisance in surrounding areas.
   b. Do not use water to control dust when it will result in flooding or

pollution or other hazardous or objectionable conditions.

2. Fire: Do not dispose of demolished materials or trees, etc., by burning.
3. Explosives: The use of explosives is not allowed.

D. Site Inspection: Inspect entire project area to determine extent of removal, salvage, and patching work.

1.04 SCHEDULING

A. Activities in areas next to removal areas cannot be interrupted or disturbed during normal facility hours.

1. Consult with the Owner and A/E to schedule work.

B. Utility Companies:

1. Coordinate with applicable utility companies and the Owner for utility line removal, if any, and related capping and utility shutdowns required by such removal work.

C. Removals:

2. Assign removals to appropriate trades under respective sections, best suited for this type of work to avoid unnecessary damage due to the efforts of unskilled workers.

PART 2 PRODUCTS

2.01 DISPOSITION OF MATERIALS NOT INDICATED OR SPECIFIED TO BE SALVAGED

A. Title to Materials:

1. Title to materials and equipment to be removed, except salvageable equipment to be retained by the Owner, is vested in the Contractor upon receipt of Notice to Proceed.

a. The Owner will not be responsible for condition, loss of, or damage to such materials and equipment after receipt by Contractor of Notice to Proceed.

B. Remove excess materials and equipment not specified to be salvaged from site and premises upon completion of removal operations.

PART 3 EXECUTION

3.01 REMOVAL WORK

A. Perform removal work indicated on drawings or as specified in an orderly manner according to accepted construction schedule.

1. Protect work specified to remain.
2. Protect adjacent areas from damage or undue dirt and dust.
3. Wet down debris or rubbish, if necessary, to minimize flying dust.

3.02 EXISTING UTILITIES

A. Utility work shall be performed according to these specifications for the utility service involved.

3.03 EXISTING WORK

A. Existing work may be cut, altered, removed, or temporarily removed and replaced as necessary for the performance of work required.

1. Exception: Unless otherwise indicated on drawings do not cut or alter structural members without authorization by the A/E.

B. Filling: Holes and other hazardous openings created by removal work shall be filled following procedures specified in Section 312000 – Earth Moving.

C. Restore damaged or defaced areas or items, remaining in place, of work performed under this Contract to comparable conditions existing before the work.

END OF SECTION 311300

SECTION 312000 – EARTH MOVING

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes: Earthwork for buildings and grassed or landscaped areas as indicated on Drawings and specified in this section.

B. Related Sections:

1. 320190.23 – Tree & Shrub Preservation.
2. 329223 - Sodding.

1.02 REFERENCES:

A. American Society of Testing Materials, (ASTM):

B. Florida Department of Transportation (FDOT)

1.03 DEFINITIONS: (Not Used)

1.04 SUBMITTALS: The Contractor shall submit soil samples to landscape architect for approval.

1.05 QUALIFICATIONS: (Not Used)

1.06 RESPONSIBILITIES: (Not Used)

1.07 CERTIFICATIONS AND TESTINGS: Field density tests in accordance with ASTM Standards, for each type of material used in backfilling shall be required. Failure to meet the specified density will require the CONTRACTOR to recompact and retest, at his own expense, those areas directed by the ENGINEER

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the ENGINEER as requested for inspection. The Contractor shall provide 48 hours notice of its intention to begin new WORK activities.

1.09 WARRANTY: (Not Used)

PART 2 - PRODUCTS

2.01 MATERIALS ENCOUNTERED:

A. The CONTRACTOR may consider all materials encountered in excavations, excluding peat unless the quantities are less than 25 percent of the total volume, as suitable for use as unclassified random fill.

B. The CONTRACTOR shall use only material that is free of debris, roots, and organic matter in all fill areas. Peat materials are not suitable for use in select fill.

1. Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands generally exclusive of clayey and silty material - materials which are free-draining and for which impact compaction will not produce a well-defined moisture-density relationship curve and for which the maximum density by impact methods will generally be less than by vibratory methods.
2. Cohesive materials include silts and clays generally exclusive of sands and gravel - materials for which impact compaction will produce a well-defined moisture-density relationship curve.

PART 3 - EXECUTION:

3.01 SITE PREPARATION:

A. Clearing and Demolition: The CONTRACTOR shall perform clearing and demolition as specified in Section 024100 - Demolition and Section 311000 - Site Clearing.

3.02 EXCAVATION AND TRENCHING:

A. Trenching for Pipes: The CONTRACTOR shall perform trenching for pipes as shown, required and specified.

3.03 BACKFILLING:

A. Pipe Embedment and Backfill: The CONTRACTOR shall perform pipe embedment and backfill as required, shown and specified.

3.04 MAINTENANCE:

A. The CONTRACTOR shall protect newly graded areas from actions of the elements.

B. The CONTRACTOR shall fill, repair and re-establish grades to the required elevations and slopes for any area that shows settling or erosion occurring prior to sodding .

END OF SECTION

SECTION 312200 - SITE GRADING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements and Division 1 - General Requirements shall govern the work under this Section.

B. General Notes and Specifications, including Grading and Drainage notes as indicated on the Drawings.

1.2 WORK INCLUDED

A. The work covered by this Section shall include all labor, equipment, services and materials necessary for bringing the entire site to elevations shown in the plans. The work included in this Section shall include all necessary excavations for streets and landscape. It shall include the construction of embankments and fills by the loading, movement, deposition and compaction of suitable fill materials resulting from above listed excavations. It shall include stockpiling of any excess material to an on-site location as specified by the Owner.

B. It shall include rough grading within the roadways to the elevations or cross-section details shown on the drawings.

C. It shall include the erection and maintenance of any barricades that are required for accident prevention and property protection.

D. It shall include removal and disposal of muck, rock boulders or any foreign material interfering with construction.

1.3 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL

A. The CONTRACTOR shall be acquainted with all work to be performed as specified and shown on the Drawings. The CONTRACTOR shall ascertain where all excavation will be required and shall be solely responsible for all excavating to complete the Contract.

B. CONTRACTOR shall familiarize itself with the project geotechnical report and maintain it on-stie at all times.

3.2 PAYMENT

A. No extra payment will be allowed for type or classification of material in excavation.

3.3 MATCHING EXISTING GRADES

A. Where existing roadbed surfaces are not at the elevation required prior to subgrade compaction, the CONTRACTOR shall perform any such excavation, filling, earthmoving and grading as may be necessary to attain the proper compacted subgrade elevation before proceeding with base course construction.

3.4 UNSUITABLE MATERIAL

A. All muck, large rocks and boulders encountered during the work under this Contract shall be removed and disposed of in a manner approved by the Owner.

3.5 EXCAVATION

A. The CONTRACTOR shall make probings or sounding for subsurface rock to ascertain its location and depth.

B. It shall be the CONTRACTOR's responsibility to be familiar with soil conditions on the site. Borings shall be acquired by the CONTRACTOR, at the CONTRACTOR's expense.

C. Any wet excavated materials shall be drained before hauling or moving.

3.6 EMBANKMENT (FILL)

A. Embankment shall be constructed from suitable materials resulting from roadway or site excavation or approved materials furnished from off-site borrow areas.

B. The existing material on the site may vary as to stability. The CONTRACTOR shall be satisfied by site inspection borings, probings, etc., prior to bidding, as to the subsurface character of the material.

C. All unstable soil shall be removed and replaced by material approved by the GEOTECHNICAL ENGINEER.

3.7 GRADING

A. The material shall be graded so that the finished grade shall be within +0.1 feet of the grades indicated by the grade stakes and control point elevations shown on the plans and by the cross-sections.

3.8 FINISH GRADING

A. Following completion of the paving work, all landscape areas along the roadway shall be shaped and graded to the elevations and cross-sections shown on the drawings. The finished surface shall be maintained until landscape work is completed.

3.9 SURVEYS

A. All initial surveys, including detail construction stakes, will be furnished by the CONTRACTOR.

B. The CONTRACTOR will carefully maintain benchmarks, monuments, stakes and other reference points, and if disturbed or destroyed, be replaced as directed at the CONTRACTOR's expense.

END OF SECTION 312200

SECTION 312333 - EXCAVATION AND BACKFILLING FOR UTILITIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this Section.

1.2 WORK INCLUDED

A. The work shall consist of furnishing all materials, labor and equipment for excavation, trenching and backfilling for utilities. "Utilities" shall include stormwater drains, culverts, water and sewer mains and appurtenant structures, lighting foundations and conduit, traffic signal interconnect and data (i.e.AT& T) facilities.

1.3 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 EXCAVATION

A. General: This work shall consist of the excavation of whatever substances shall be encountered to the depths as shown on the plans. Excavated materials not required for fill or backfill shall be removed from the work site as directed by the ENGINEER and shall be considered to be a part of the bid price of the utility pipe for which excavation and backfill is required.

B. Excavation for structures and other accessories shall have a minimum clearance of twelve (12) inches and a maximum clearance of twenty-four (24) inches on all sides.

C. Excavation shall not be carried below the required depths as indicated by the plans. Excess excavation below the required level shall be backfilled at the CONTRACTOR's expense with sharp sand, gravel or other suitable material thoroughly compacted and approved by the ENGINEER.

D. Any unstable soil shall be removed and shall be replaced by material acceptable to the ENGINEER. The removal and replacement of such unstable soil shall be considered to be part of the bid price of the pipe for which excavation and backfill is required.

E. Water shall not be permitted to accumulate in the excavated area. It shall be removed by pumping or other means as approved by the ENGINEER. The removal of water shall be considered to be a part of the bid price of the pipe for which excavation and backfill is required.

F. If the bottom of the trench is rock, the excavation shall be carried eight (8) inches below the invert of the pipe and backfilled with thoroughly compacted sharp sand, gravel or other suitable material.

G. Rock excavation shall include any rock encountered which cannot be removed with a 3/4 yard backhoe under normal operating conditions. Rock excavation shall be incidental to construction of all piping systems and no separate payment will be made.

H. Whenever it is necessary, in the interest of safety, to brace or shore the sides of the trench, such bracing or shoring shall be considered to be part of the bid price of the pipe for which excavation and backfill is required.

1. The CONTRACTOR shall furnish, put in place and maintain such sheeting, bracing, and for shoring as may be required to support the side of the excavation, and to prevent any movement which can in any way damage the work or endanger adjacent structures. If the ENGINEER is of the opinion that supports are insufficient, the ENGINEER may order additional supports. The compliance with such order shall not release the CONTRACTOR from the CONTRACTOR's responsibility for the sufficiency of the sheeting.

2. The CONTRACTOR shall leave all sheeting in place. The ENGINEER may require sheeting to be cut off at any specified elevation, but in no case will any sheeting be left closer than two (2) feet below the natural surface, nor cut off below the elevation of the top of the pipe.

3.2 ROCK EXCAVATION

A. Rock excavation shall include removal and disposal of the following: (1) all boulders measuring 1/3 of a cubic yard or more in volume; (2) all rock material in ledges, bedding deposits, and unstratified masses which cannot be removed without systematic drilling and blasting; (3) concrete or masonry structures which have been abandoned; and (4) conglomerate deposits which are so firmly cemented that they possess the characteristics of rock.

3.3 BACKFILLING

A. After pipes, structures and other appurtenances have been installed, the trench or opening shall be backfilled with material free from large stones or clods of a quality acceptable to the ENGINEER.

B. Backfill around the pipe and to a point twelve (12) inches above the top of the pipe shall be placed in six (6) inch layers compacted with twenty (20) pound hand tampers or mechanical tampers suitable for this purpose. Backfilling shall follow pipe-laying closely, and shall not be more than one hundred (100) feet behind completed pipe-laying. Backfill over pipe shall be carefully placed by experienced labor and thoroughly consolidated without shock to the pipe, and carried up uniformly on both sides of the pipe. No backfilling with bulldozers will be permitted adjacent to pipe line.

C. Within roadway right-of-ways, or within areas where pavements are to be constructed over the pipe, the remainder of the trench shall be placed in six (6) inch layers (compacted thickness) and shall be compacted to 100% of maximum density as determined by AASHTO T-99. CONTRACTOR will be responsible for correcting settlement in all backfilled areas whether under the pavement or otherwise.

D. In areas where no pavement is to be constructed, the backfill above the twelve (12) inch line above the pipe shall be compacted to a firmness approximately equal to that of the soil adjacent to the pipe trench or 95% of maximum density as determined by AASHTO T-99 in public rights of way. Backfill below the twelve (12) inch line shall be compacted in six (6) inch layers (compacted thickness) and shall be compacted to 100% of maximum density as determined by AASHTO T-99.

3.4 EXPLOSIVES

A. The use of explosives will not be permitted.

3.5 PAYMENT

A. No separate payment is provided for work covered by this Section. All costs in connection with Excavation and Backfilling, including testing, shall be included in the bid price of any item for which excavation and backfilling is required.

END OF SECTION 312333

SECTION 314500 – VIBROFLOTATION AND DENSIFICATION

PART 1

1.01 SCOPE OF WORK

A. This section shall include but Is not limited to providing all equipment, material, labor, supervision and related services to do all soil improvement by Vibro-Replacement as specified herein and as indicated in the drawings and other contract documents.

B. Soil improvement by Vibro-Replacement will be limited to the areas as specified and indicated on the project

1.02 BID REFERENCE

A. All Vibro-Replacement bid work shall be based upon the following (i.e. foundation plans, discussions, soil reports, etc.)

1.03 FIBROUS CONCRETE REINFORCEMENT

A. Perform appropriate Vibro-Replace with granular backfill material as specified to provide the following criteria upon successful completion of each.

B. Vibro-Replacement

1. An allowable soil bearing capacity of 7,000 pounds per square foot (psf) with a limitation of 1 inch of total settlement.

2. Densification by Virbro-Replacement should be carried out to at least a depth equal to the zone of influence of the footing. The zone of influence is equal to twice the width of a column footing and four times the width of a wall footing measured from the bottom of the footing as shown on the drawings.

3. A relative density of an average of 15 blows per foot as measured by 5 foot borings (ASTM D 1586).

1.04 BACKFILL MATERIALS

A. Vibro-Replacement

1. Unless otherwise stated, stone shall be used for Vibro-Replacement. The backfill stone should consist of relatively hard, angular to subangular durable rock fragments with the size of particles ranging from 3/8 inch to 1½ inch. The material to be used should be approved by Engineer. Flaking material should not be used.

1.05 EQUIPMENT AND PROCEDURES

A. Specific equipment and procedural specifications are left to the Vibro Contractor performing the Vibro-Replacement work to achieve the specified criteria. However, the following general guidelines shall be used.

1. The specialty Vibro Contractor shall use a down hole vibrator capable of providing at least 80 HP of rated energy and centrifugal force of 15 tons. An appropriate metering device should be provided at such a location that inspection of pressure building up may be verified during the operation of the equipment. Metering device may be an ammeter, or a RPM meter direction indicting the performance of the vibrator tip of the eccentric. Complete equipment specifications should be submitted to Engineer prior to commencement of the field work.

2. The specialty Vibro Contractor shall have a minimum of (5) years experience and shall provide documentation of successful job completion relevant to the specific application to this job.

3. After penetration to the required depth, the vibrator probe shall be withdrawn at a rate of 1 foot in 30 to 60 seconds. The vibrator probe shall not be withdrawn more than 2 feet at any time.

4. Redriving the vibrator into the treated depth shall be attempted at approximately 2.0 to 3.0 feet intervals to observe resistance to penetration and pressure/amperage build-up.

5. Amperage build-up and backfill quantities will be contingent upon the type of vibrator used and procedures. Prior to commencement of work, the Contractor shall discuss the equipment capabilities with Engineer to determine if trial probes will be necessary.

1.06 TESTING AND INSPECTION

A. All testing to determine specification compliance will be provided by Engineer, paid by the Owner, and will consist of Standard Penetration Test (SPT) boring and on-site observation during and after the Vibro-Replacement.

B. SPT borings shall be performed at locations at points which are equidistant and farthest from two, three, or four probes, whichever is applicable, with a multiple probe pattern under a column or wall footing.

C. The work should consider an averaging of SPT values for the test hold, and also the work should relate to parameters used in the stone column design (e.g. to limit settlement to 1 inch and to provide a bearing capacity of 7,000 psf, etc.) as determined by the SPT work.

D. Areas of the site not adequately densified as determined by the specific SPT values shall be recompacted by Vibro-Replacment at no additional cost to the Owner.

E. Engineer will provide site inspection to insure performance of the Vibro-Replacement work. This inspection may include the following: observance of the Vibro Contractor's procedures, recording of backfill quantities, and recording ammeter information.

F. A sample of the type of backfill material should be submitted to Engineer for a grain size distribution analysis to establish the suitability, the cost of which will be borne by the General Contractor.

1.07 LAYOUT OF WORK

A. After the initial rough grading of the Vibro treatment area, the General Contractor shall accurately lay out grid lines for the Vibro Contractor to located stone column points, as shown on the pattern drawings furnished by the Vibro Contractor.

1.08 SUBMITTALS

A. The Vibro Contractor shall furnish a shop drawing to the Geotechnical Engineer (for achieve the criteria outlined in the specifications.

B. A daily log shall be submitted to the Owner by the Vibro Contractor to include recording of probe number, start/finish time of probe, depth of treatment, approximate backfill quantities, and indication of relative ammeter increases.

C. Any change in the predetermine Vibro program necessitated by a change in the subsurface conditions will be immediately reported and submitted to Engineer.

1.09 COMPLETION REPORT

A. Upon completion of the Vibro-Replacement work, Engineer would prepare a report to the Client documenting the observations and results of the SPT tests. This report shall in no way imply any guarantee of performance. This shall be the Vibro Contractor's r esponsibility as specified in the general contract documents.

END OF SECTION 314500

SECTION 316800 – FOUNDATION ANCHORS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies test anchors and production anchors, including Double Corrosion Protection System, drilled holes, grouting and testing for rock anchors, and also tie rods.

1.02 SUBMITTALS

A. Submit the following samples and data:

1. One five foot length of anchor having the Double Corrosion Protection System indicated on the drawings.
2. One complete stressing head assembly.
3. Certified mill report for threadbar tendon.
4. Certified mill report for stressing head assembly.
5. Certification for factory applied epoxy coated ends.
6. Certification for compressive and tensile strength of corrugated and smooth sheathing.

1.02 SHOP DRAWINGS

A. Submit detailed shop drawings showing the anchor with the double corrosion protection system; location, size and length; installation, testing procedures and equipment.

1.03 EXPERIENCE

A. The foundation systems Contractor and anchor supplier shall furnish evidence that they have been engaged in the successful installation, supply and testing (respectively) of anchors for at least five years.

1.04 QUALITY CONTROL

A. Supervision - A qualified representative of the manufacturer shall supervise the installation and testing of two rock anchors.

B. Testing of Grout - Random sampling and testing of cement grout for test anchors shall be performed and required by Engineer to verify strength. Test procedure in accordance to ASTM C-109.

PART 2 - PRODUCTS AND MATERIALS

2.01 ROCK ANCHORS

A. Each anchor shall consist of a single, deformed bar of prestressing steel encased in P.V.C. corrugated sheathing.

B. A smooth sheathing fitting snugly over the corrugated sheathing in the free stressing length shall guarantee unobstructed elongation during stressing.

C. The deformed prestressing bar shall be centered in the corrugated sheathing and the annular space between the bar and the sheathing shall be filled with cement grout.

D. The anchor shall be preassembled and pre-grouted at the factory prior to shipping to the jobsite.

E. The PVC sheathing shall form a gas and water-tight barrier around the prestressing steel bar.

F. The protruding bar exposed from the corrugated sheathing shall have factory-applied epoxy coating.

G. A steel seamless pipe (trumpet) welded to the steel bearing plate shall guarantee continuity of corrosion protection. The seamless pipe shall be sufficient length to overlap the corrugated sheathing.

H. A steel hexagonal nut with a round head shall fit into the countersunk hole in the bearing plate.

I. Both the steel hexagonal nut and bearing plate with trumpet shall have factory-applied epoxy coating.

J. A plastic cap and plastic nut filled with mastic corrosion inhibitor (grease) will encapsulate the hexagonal nut for corrosion protection.

2.02 PRESTRESSING STEEL

A. The prestressing steel tendons for rock anchors shall be threaded bars, Grade 150 KSI conforming to ASTM Designation A-722, Type II, cold stretched and stress relieved after the threading process. Each bar shall be factory proof stressed after the threading operation to a minimum of 80% of the guaranteed minimum tensile strength.

2.03 PLASTIC SHEATHING

A. Corrugated plastic sheathing shall be poly-vinylchloride, having a minimum compressive strength of 15,000 psi and tensile strength of 7,000 psi.

B. Material shall be free of water soluble chlorides and other ingredients which might enhance corrosion, hydrogen embrittlement or stress corrosion on the

prestressing steel. The plastic shall be non-reactive with the grout and its ingredients.

C. The plastic sheathing shall be gas and water-tight, resistant against chemical attaches and aging.

2.04 ACCESSORIES

A. Steel Bearing Plates shall conform to ASTM A-36.

B. Nuts shall be hexagonal, heavy duty type with round head, conforming to ASTM A-325 or the bar manufacturer's specifications.

2.05 MISCELLANEOUS

A. Grease for the stressing head assembly shall be a mastic corrosion inhibitor, waterproof, non-corrosive, non-hardening sealing compound.

B. Epoxy coating shall conform to ASTM A-775.

2.06 CEMENT GROUT FOR ROCK ANCHORS

A. Cement grout for grouting anchors shall be neat cement, with a water-cement ratio of 0.45 by weight. An approved additive shall be mixed with the grout as an expanding agent.

B. The cement grout shall have sufficient strength to guarantee the load transfer between the threaded bar and the corrugated sheathing. The minimum 28 day compressive strength shall be 6,000 psi.

2.07 TIE RODS

A. New tie rods shall conform to ASTM A36. Attachments to existing tie rods shall be as per drawings.

PART 3 - EXECUTION

3.01 ROCK ANCHORS

A. General

1. Rock anchors shall have the Double Corrosion Protection System and shall be installed in a percussion drilled hole, fully grouted with cement grout, tension tested, and pre-tensioned to the specified load.

2. Where drilled through soil, the rock anchor hole shall be permanently cased to the top of the underlying rock.

B. Installation of Rock Anchors

1. Install production rock anchors at the locations indicated. Install type test rock anchors at locations to be designated by the Engineer.

2. Drill minimum 3 3/4 inch diameter holes, or larger, if recommended by manufacturer, a sufficient distance into bedrock to provide the capacities required, but not less than the minimum distance indicated. Use percussion drilling methods. Over-drill the hole at least six inches deeper than the depth indicated, but not more than 12 inches.

3. Where drill holes first penetrate through soil, install four inch minimum I.D. steel casings to the top of rock during drilling. Additionally, where required to maintain drill hole stability in rock, four inch minimum I.D. steel casings shall be installed during drilling.

4. Each drill hole for the type test rock anchors and one out of every ten production rock anchor drill holes, shall be water pressure tested by isolating the bottom 20 feet of the drill hole, using an expandable packer and subjecting the bottom portion of the hole to a water pressure 5 psi above hydrostatic pressure for at least ten minutes.

a. A gage capable of measuring to 0.01 gallons shall be used to measure water flow into the isolated zone. The isolated portion of drill hole with an average rate of water loss greater than 0.25 gallons per minute, as measured over at least ten minutes, shall be pressure grouted with cement grout at a pressure of at least 5 psi above hydrostatic pressure. Pressure grouting shall be carried out for at least ten minutes. Allow at least one day for grout to set, then re-drill grouted holes as required.

5. Clean the drill hole, or re-drilled hole, of all soil and rock fragments and other debris.

6. Insert the rock anchor in the drill hole.

7. Grout the annular space between the rock anchor and the drill hole with cement grout, using Tremie method to expel all water and loose debris from the drill hole. The bottom of the tremie pipe shall not be raised above the top of the grout in the drill hole during tremie grouting.

a. Grout the entire bar length to the top of the hole. Re-grout as necessary if grout settles. The rock anchor will be considered grouted when there is full return of undiluted grout from the top of the hole. If grout loss from the drill hole exceeds three times the volume of the annular space between the drill hole and the rock anchor, grouting shall be discontinued, the rock anchor removed from the hole and the drill hole fully grouted. Re-drill the hole after at least one day.

8. Performance test each type test rock anchor as described in Section 3.10 (D).

9. Temporarily protect rock anchors from damage such as being bent or having corrosion protection layer chipped or cut during construction.

10. Proof test each production rock anchor as described in Section 3.10(E).

11. Within 72 hours after acceptance of rock anchors, complete stressing head assemblies of all rock anchors by installing non-corrosive grease, grease retention cap and nut in a manner to expel all air and water; coat all exposed surfaces of the stressing head assembly and bearing plate with epoxy, applied in accordance with manufacturer's specifications.

C. Anchor Testing and Stressing - Each rock anchor shall be tested. The maximum test load shall not exceed 80 percent of the guaranteed ultimate tensile strength (GUTS) of the tendon.

D. Performance Test

1. All test type anchors shall be performance tested.

2. The performance test shall be made by incrementally loading and unloading the anchor in accordance with the following schedule. At each increment, the movement of the tendon shall be recorded to the nearest .001 inches (0.0025 cm) with respect to an independent fixed reference point. The jack load shall be monitored with a pressure gauge or load cell. The increment of load shall be: P=design load for the anchor; AL=alignment load.

3. Performance Test:

O
.25P
AL
.25P
.50P
.25P
AL
.25P
.50P
.75P
.50P
.25P
Al
.25P
.50P
.75P
1.00P
.75P
.50P
.25P
AL
.25P

.50P
1.00P
1.20P
1.33P (Hold for Creep Test)
Adjust to Transfer Load

The test load shall be held for 10 minutes. Total movements with respect to a fixed reference point shall be recorded at 1 minute, 2, 3, 4, 5, 6 and 10 minutes. If the total movement between 1 minute and 10 minutes exceeds 0.04 in. (1mm), the test load shall be held for an additional 50 minutes. Total movements shall be recorded at 15 minutes, 20, 25, 30, 45 and 60 minutes.

E. Proof Test

1. All production anchors shall be proof tested. The proof test shall be performed by incrementally loading the anchor in accordance with the following schedule. At each increment, the movement of the tendon shall be recorded to the nearest .001 inches (.0025cm) with respect to an independent fixed reference point, if possible. The jack load shall be monitored with a pressure gauge or load cell. The increments of load shall be: P = design load for the anchor.

2. Proof Test:

0
.25P
.50P
.75P
1.00P
1.25P (Hold for creep test)
Test Load
Adjust to Transfer Load

3. The proof test results should be compared to the performance test results. Any significant variation from the performance test results warrants making a performance test on the next anchor.

F. Acceptance Criteria

1. The Engineer shall investigate the anchor test results and determine whether the anchor is acceptable. An anchor shall be acceptable if:

a. The total elastic movement obtained from a performance test should exceed 80 percent of the theoretical elastic elongation of the stressing length and be less than the theoretical elastic elongation of the stressing length plus 50 percent of the bond length.

b. The creep movement does not exceed .080 inches (0.20cm) during the final time increment of the performance test regardless of tendon length and load.

c. The lift-off test shows an anchor load within 10 percent of the specified transfer load.

2. The Engineer shall determine whether an anchor which fails to meet the above minimum acceptance criteria may be incorporated in the work.

G. Alignment - After sheet piling is installed and backfilling is completed, align wall by increasing or decreasing the stress in the tie rods. Tie load in the tie rods may be increased or decreased a maximum of 2,000 pounds.

3.02 TIE RODS

A. Existing tie rods shall be spliced and extended to the new sheet piling as shown on the drawings.

B. Backfilling

1. Backfill behind new sheet piling wall to 2 feet below tie rod.

2. Stress tie rod to a total of 12,000 pounds.

3. Backfill behind wall to full height.

4. Stress tie rod to a total of 21,500 pounds.

C. Alignment - After sheet piling is installed and backfilling is completed, align wall by increasing or decreasing the stress in the tie rods. Tie load in the tie rods may be increased or decreased a maximum of 2,000 pounds.

PART 4 - MEASUREMENT AND PAYMENT

4.01 ROCK ANCHORS

A. Rock anchors, including furnishing of all bars, bearing plates, drill hole casing, nuts, washers, drilling, drill hole cleaning, sealing, water pressure testing, pressure grouting, re-drilling as necessary, installing, tremie grouting, testing, and pre-tensioning, shall be measured per each type of rock anchor installed and tested. Type test rock anchors shall also include removal of stressing head assembly, concrete stressing platform, and rock anchor above ground surface.

B. No separate payment will be made for pressure grouting and re-drilling drill holes.

C. No payment will be made for rejected rock anchors, nor for more than one required replacement for each rejected rock anchor.

D. Payment for rock anchors will include the cost of the required manufacturer's qualified representative's services.

END OF SECTION 316800

SECTION 320190.23 – TREE & SHRUB PRESERVATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Protection of existing trees from damage because of Contractor's operations including, but not limited to:

1. Vegetation protective signage.
2. Tree protection fencing.
3. Boxing of tree trunks.
4. Root pruning, construction pruning, and root protection.

B. Related Sections:

1. 312000 – Earth Moving

1.02 SUBMITTALS

A. Proposed methods and schedule for tree and plant protection.

B. Proposed methods, materials, and schedule for root pruning, construction pruning, and tree fertilization.

1.03 QUALITY ASSURANCE

A. A. Comply with the most stringent applicable requirements of the following standards.

1. American National Standards Institute (ANSI) – Safety Requirements for Pruning, Trimming, Repairing, Maintaining and Removing Trees, and for Cutting Brush.
2. International Society of Arboriculture (ISA) - Guide for Establishing Values of Trees and Other Plants.
3. National Arborist Association (NAA) - Ref.1, Pruning Standards for Shade Trees.
4. International Society of Arboriculture (ISA) - Construction Management Guidelines.

B. Damaged Trees/palms:

1. 1. Trees scheduled to remain and are damaged during construction shall be replaced per canopy equivalency at no expense to the Owner.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Tree Protection Fencing:

1. See plan details

B. Boxing (Fencing):

1. See plans.

C. Root Pruning:

1. Liquid fertilizer applied to root pruned and construction pruned trees shall be Peters M77 Sequestered-Cleated Soluble Fertilizer by W.R. Grace and Co., Cambridge, MA, or accepted equivalent.
2. Dormant oil spray shall be a dormant miscible spray, Volck Oil, by Ortho or accepted equivalent.

PART 3 EXECUTION

3.01 INSTALLATION

A. Fencing:

1. Before start of demolition work and clearing and grubbing operations, tree protection fencing shall be installed at all trees designated to be protected. Fencing shall be installed a minimum of 15 feet beyond the drip line of trees to be protected, unless otherwise accepted by the A/E.

B. Boxing:

1. Box trees to remain and not within designated tree protection areas.

C. Root Pruning:

1. Where construction will occur close to existing trees designated to remain, roots shall be pruned. Proximity shall be as determined in the field by the A/E.
2. Root pruning is the physical cutting of tree roots to minimize root damage and promote healing. Suitable means for root pruning include trenching, vibrating plow, or stump grinder. Any method capable of tearing roots or disturbing the soil beyond the grading limit is not allowed.
3. Root prune trees as noted to a depth of 24 inches by trencher, backhoe, or other approved means.
4. Backfill root pruning trench with existing soil mixed with peat moss or well-rotted sawdust to a mixture of approximately 75 percent soil and 25 percent humus. Tamp lightly to set soil.

5. Apply mulch to a depth of 4 inches at minimum dripline radius around tree to reduce compaction and increase moisture retention. Mulch depth shall be feathered to grade at base of trunk.

D. Construction Pruning and Root Protection:

1. To compensate for root zone damage by cut or fill work, prune top of tree to approximate percent of damaged root zone area.
2. Construction pruning shall consist of pruning the tree crown to compensate for root zone damage due to construction operations. Construction pruning shall include a fertilization/insecticide program.
3. Construction pruning shall comply with NAA Ref.1 for Class IV – Crown Reduction Pruning and ANSI Zl33.1.
4. For those trees remaining within construction zone to be protected, apply mulch to a depth of 6 inches within dripline radius around tree to reduce compaction and increase moisture retention. Mulch depth shall be feathered to grade at base of trunk. Remove protection mulch after completion of work as specified.

E. Fertilization and Insect Spraying:

1. Treat root pruned and construction pruned trees with liquid fertilizer, dormant oil spray, and insecticide.
    a. Liquid fertilizer shall be applied at a rate recommended by the manufacturer and as required by NAA Ref.2.
    b. Apply dormant oil spray, at a rate recommended by the manufacturer, in early spring before buds begin to swell.
    c. Apply insecticide spray twice to root pruned trees following application of dormant oil spray. Spray insecticide at rates recommended by spray manufacturer at intervals appropriate for effective insect control.

F. Removal of Protection:

1. Except as otherwise indicated or requested by A/E, temporary protection devices and facilities installed during course of the work shall be removed only after all work that may injure or damage trees and plants is completed.

END OF SECTION

SECTION 321000 - ASPHALT PAVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All applicable provisions of the bidding and Contract Requirements and Division 1 - General Requirements shall govern the work under this Section.

1.2 WORK INCLUDED

A. This Section of the specifications covers the control and general conduct of asphalt paving construction for roads.

B. Provide all labor, materials, necessary equipment and services to complete the Asphalt Paving work, as indicated on the drawings.

C. Including, but not necessarily limited to the following:
1. Preparation of subgrade.
2. Installation and compaction of base course.
3. Spreading of asphalt surface course.

1.3 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

1.4 TRAFFIC CONTROL

A. The CONTRACTOR shall provide and maintain access to and from all properties along the line of the CONTRACTOR's work. The CONTRACTOR shall also provide temporary by-passes and maintain them in a safe and usable condition whenever detouring of traffic to parallel routes cannot be done without hardship or excessive increases in travel by the public.

1.5 SPECIAL SUBGRADE CONDITIONS

A. When special subgrade conditions are encountered for which these "Asphalt Paving Specifications" are not applicable, portions of these specifications shall be deleted or revised to provide a properly finished paved surface. A requested revision or deletion of the specifications shall be accompanied with reports and laboratory tests on existing field conditions. Any change from these "Asphalt Paving Specifications" shall be approved by the ENGINEER and shall be in effect only for a specified area or paving project.

1.6 QUALITY ASSURANCE

A. American Association of State Highway and Transportation Officials (AASHTO) latest edition:

B. D.O.T. Standard Specifications.

1. Work and materials shall conform to all applicable requirements of Florida Department of Transportation "Standard Specifications for Road and Bridge Construction, latest edition" (referred to herein as D.O.T.).

C. American Society for Testing and Materials.
1. ASTM D-3515 "Standard Specification for Hot-Mixed, Job Laid, Bituminous Paving mixtures."

1.7 SUBMITTALS

A. Provide copies of materials, notarized certificates of compliance signed by material producer and the CONTRACTOR, certifying that each material item complies with, or exceeds, specified requirements.

1.8 JOB CONDITIONS

A. Apply prime and tack coats when ambient temperature is above 50 degrees, and when temperature has not been below 35 degrees for twelve (12) hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Construct asphalt surface course only when atmospheric temperature is above 40 degrees, and when base is dry. Base course may be placed when air temperature is above 30 degrees, and rising.

1.9 LOCATIONS, LAYOUT AND GRADES

A. Locate and layout paved areas and right-of-ways with reference to benchmarks, property lines or buildings according to the drawings and as accepted by the ENGINEER.

B. Determine locations of paved edges and right-of-way line from surveyor's permanent reference monuments and information on the drawings.

C. Where permanent reference monuments are not available, obtain proper line locations from authorities having jurisdiction.

D. Establish and maintain required lines and elevations.

PART 2 – PRODUCTS

2.1 FILL

A. All fill shall be clean rock and sand (maximum rock size = 1 inch).

B. Fill shall be compacted thoroughly.

2.2 LIMEROCK

A. Limerock shall be obtained from pits for which all overburden has been removed previous to blasting and shall show no tendency to air slake and must undergo the following chemical requirements.

	Percent
1. Carbonates of Calcium	Min.70.0 (Miami Limerock) and Magnesium. 95.0 (Ocala Limerock)
2. Oxides of Iron and Aluminum	Max. 2.0
3. Organic Matter	Max. 0.5

4. Any constituents of other than the above shall be silica or inert material.
5. The material shall be crushed to such size that not less than 97% shall pass a 3-1/2" sieve and it shall be graded uniformly down to dust. All fine material shall consist entirely of dust of fracture.
6. Limerock from on-site may be used if the material meets the requirements of this Section of the specifications.

B. All limerock shall comply with requirements set forth under D.O.T. Specifications and the City of Delray Beach Engineering Standards for Public Works & Utility Systems.

C. Equipment: The equipment for constructing the rock base shall be in first class working condition and shall include:
1. Three-wheel roller weighing not less than ten tons.
2. Self-propelled blade grader weighing not less than three tons. The wheelbase shall be not less than fifteen (15) feet and blade length not less than ten feet.
3. Scarifiers shall have teeth space not to exceed four and one-half (4-1/2) inches.
4. Provision for furnishing water at the construction site by tank or hose at a rate not less than fifty (50) gallons per minute.

2.3 PRIME COAT

A. Prime coat shall be Grade RC-70, cut-back asphalt, D.O.T. Specifications.

B. Prime coat shall have full compatibility with surface treatment asphalt.

C. The bituminous material shall conform to the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction and the City of Delray Beach Engineering Standards for Public Works & Utility Systems.

D. The sand for cover shall be clean dry sand.

2.4 TACK COAT

A. The bituminous material to be used for the tack coat shall conform to the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction and the City of Delray Beach Engineering Standards for Public Works & Utility Systems.

2.5 ASPHALT

A. General
1. The asphaltic concrete surface course shall be in accordance with the City of Delray Beach Engineering Standards for Public Works & Utility Systems for Type S-1 and Type S-3 Asphaltic Surface Course.
2. Pavement within public road right-of-way which has been disturbed by this construction shall be replaced with the same type and thickness to match the existing pavement Section.

B. General Composition of Mixtures:
1. The aggregate in the asphaltic concrete shall be crushed stone and manufactured sand screening of natural sand or combination of both when necessary to meet requirements of composition of mix.
2. The mineral aggregate shall be so graded, and the prescribed constituents, prepared as hereinafter set out, shall be combined in such proportions as to produce a mixture conforming to the following general composition limits by weight:

Constituent	S-1 Passing Sieve	S-3 Percent by Weight	Percent by Weight
Course Aggregate	3/4"	100	100
	1/2"	80-100	100
	3/8"	75-93	88-100
	No. 4	47-75	60-90
Total Course Aggregate	No. 10	31-53	40-70
Fine Aggregate	No. 40	19-35	20-45
	No. 80	7-21	10-30
Filler	No. 200	2-6	2-6
Total Fine Aggregate and Filler	No. 10	100	100
Total Mineral Aggregate		100	100
Total Mix		100	100
Total Mineral Aggregate		91-95	
Asphalt Cement		5-9*	
(Bitumen) Total Mix		100	

*For highly absorptive aggregates the upper limit may be raised.

2.6 SEAL COATING

A. Homogeneous mixture of emulsified coal tar pitch, sand and other inert fillers. It shall be easily re-mixed if settlement occurs in storage (except in the case of freezing). It shall be capable of application and complete coverage by rubber squeegee, brush, or approved mechanical method, to the surface of bituminous pavements at the spreading rate of 0.2 to 0.3 gallons per square yard in two (2) coats.

PART 3 – EXECUTION

3.1 BARRICADES

A. Provide substantial temporary barricades around all areas of operation and maintain until work under this Section is completed and approved.

B. Install temporary traffic markers, signals, and signs as per City of Delray Beach and Florida Department of Transportation Standard Specification to:
1. Eliminate potentially hazardous conditions.

2. Maintain adequate traffic patterns free of conflict with work under this Contract.

3.02 PREPARATION OF SUBGRADE

A. This work consists of bringing the bottom of excavations and top of embankments of the roadway between the outer limits of the shoulders or base course to a surface conforming to the grades, lines, and cross-sections shown on the plans. The subgrade shall be of uniform density ready to receive the rock base of the paving course.

B. All soft and yielding material and other portions of the subgrade which will not compact readily shall be removed and replaced with suitable material and the entire subgrade brought to line and grade to provide a foundation of uniform compaction and supporting power.

C. Stumps, roots, and other deleterious organic matter encountered in the preparation of the subgrade shall be removed.

D. Where fills are required on areas covered or partly covered by existing paving, the entire area of such existing paving shall be scarified to a depth of at least six inches, and the scarified material spread evenly over the area to be filled to a width not less than that of the proposed paving.

E. Material for fills shall consist of sand or other suitable material approved by the ENGINEER free from stumps, roots, brushes, and other deleterious organic matter.

F. Where fill is more than one foot (1') in depth, the backfill material above the ground water table shall be compacted on one (8") depth lifts. Each individual layer of fill under the rock base shall have a density of 98% of the maximum density as determined by the AASHTO T-180 unless shown otherwise on the plans. Each individual layer of fill under the shoulder area shall have a density of 98% of the maximum density as determined by AASHTO T-180, unless shown otherwise on the plans.

G. The bottom of all excavated areas and the top of all fills where rock base is to be constructed shall be thoroughly compacted by rolling. Water shall be used to insure thorough compaction.

H. Bring subgrade which has been properly filled and shaped to a firm unyielding surface, by rolling an entire area with an approved power roller weighing a minimum of 10 tons.
1. Thoroughly compact area inaccessible to the roller with approved hand tamper.

2. Apply water sufficiently to compact the subgrade where the subgrade is of a dry, sandy nature and cannot be rolled.

I. The subgrade shall be maintained free from ruts, depressions or other irregularities until rock base material is spread.

J. The stabilized subgrade shall have a minimum Limerock Bearing Ratio (LBR) of 40, unless otherwise noted on the plans.

K. Where the bearing value of the existing subgrade is adequate without addition of stabilizing material, the subgrade shall be scarified and disked, harrowed, bladed or tilled for removal of boulders, roots, etc. to assure uniformity and thorough mixing of material to the full width and depth of required stabilization. The compacted subgrade shall conform to the lines, grades and cross-section shown on the plans.

L. Test subgrade for crown and elevation after preparation and immediately before base of paving course is laid.
1. Remove or add material and compact to bring to a correct elevation and uniform bearing if the subgrade is found not to be at the specified elevation at all points.
2. Adjust the manhole rims, catch basin frames and valve boxes where necessary to match proposed finish grade.

3.3 CONSTRUCTION OF BASE COURSE

A. This work consists of construction of lime rock base course for the asphalt wearing surface. The base course shall be constructed on the prepared subgrade in an eight (8) inch thick limerock bases constructed in two four (4) inch lifts as shown on the drawings. Twelve (12) inch thick limerock bases shall be constructed in two six (6) inch lifts. The limerock base shall be a minimum LBR of 100.

B. Spreading Rock: The rock shall be transported to the points where it is to be used over rock previously placed, and dumped on the end of the preceding spread. It shall then be spread uniformly with hand tools, or mechanical equipment. In no case shall rock be dumped directly on the subgrade. No hauling shall be done over the subgrade.

C. Compacting Rock
1. Following spreading, the rock shall be rolled with a three wheel roller weighing not less than ten (10) tons, water being added as required, until the entire depth of base is compacted into a dense unyielding mass.
2. No greater area of rock base shall be placed during any one day than that which can be rolled and compacted on the same day.

D. Finishing Base
1. After watering and rolling, the entire surface shall be thoroughly scarified to a depth not less than four inches (4") and shaped to exact crown and cross-section, re-watered and again thoroughly rolled. Rolling shall continue until the entire depth of base is bonded and compacted into a dense, unyielding mass, true to grade and cross-section.
   a. Any irregularities which may develop in the surface during such finishing shall be corrected by the removal or addition of rock as the case may be.

b. If at any time the subgrade material becomes churned up and mixed with the base rock, the CONTRACTOR shall dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean rock which shall be watered and rolled until satisfactorily compacted.
c. Where cracks or checks appear in the base either before or after priming, which in the opinion of the ENGINEER would impair the structural efficiency of the base course, the CONTRACTOR shall remove such cracks or checks by re-scarifying, reshaping, watering, rolling and adding rock where necessary.
d. During final compacting operations, if grading of any areas is necessary to obtain the true grade and cross-section, the compacting operations for such areas shall be completed prior to making the density tests on the finished base.

E. Inferior Rock: If in the opinion of the ENGINEER at any time during the progress of the work, rock of inferior quality is being delivered to the construction site, a laboratory analysis of the rock shall be made. Should the results of such tests indicate that the rock does not conform to specifications, the CONTRACTOR shall, at the CONTRACTOR's own expense, remove such inferior material from the area indicated and deliver and spread satisfactory rock on said area.

F. Testing Surface: The finished surface of the rock base shall be true to the required cross-section. Any irregularities in the grade greater than 1/4", as determined by placing a ten (10) foot straight edge parallel with the centerline, shall be corrected by scarifying to a depth of three inches (3"), removing or adding rock as may be required and again watering, rolling, and compacting the scarified area. In testing the surface for irregularities, the measurements under the straight edge shall not be taken in small holes caused by individual pieces of rock having been pulled out by the road grader.

G. Density: Density determinations shall be made by the CONTRACTOR or at intervals required by the ENGINEER. Required density shall be 98% of maximum density obtainable under AASHTO Method T-180.

H. Testing: The CONTRACTOR shall coordinate with ENGINEER for all testing. One test shall be made in accordance with AASHTO, T-180 for each class of material in the subgrade and base.
1. In place density tests in accordance with AASHTO T-147 shall be made in the locations shown on the plans. Two copies of the test reports will be sent directly to the ENGINEER for evaluation.
2. Any material which fails to meet these specifications shall be removed, replaced, and re-tested, all at the CONTRACTOR's expense.
3. Tests shall be taken at least every 1,000 square yards and taken at locations and lifts as directed by the ENGINEER.

3.4 PRIME COAT FOR BASE COURSE

A. Cleaning the prepared base:
1. Before any bituminous material is applied, all loose material: dust, dirt, caked clay and foreign matter which might prevent proper bond with the existing surface shall be moved to the shoulders, to the full width of the treatment, by means of revolving brooms or approved mechanical sweepers and by mechanical blowers, of approved types, supplemented by hand sweeping. Dust and other loose materials not removed

by mechanical means shall be removed with hand brooms. Particular care shall be taken to clean the outer edges of the strip to be treated in order to insure that the prime coat will adhere. Sweeping and blowing shall be continued until all the loose dust and dirt is removed from the surfaces.

2. Application of bituminous material shall be made during the same day surface has been swept and as soon as practical thereafter.

B. Application for Prime Coat:

1. The bituminous material shall be applied to the clean dry surface of the rock base at such temperature as will insure uniform distribution. The amount applied will be at the rate of approximately 0.25 gallons per square yard of base area. The application shall be made by means of self-propelled pressure distributor operating under a pressure not less than 20 pounds per square inch. Application of bituminous material shall be made on only one-half of the width of base at one time.
2. The primed base shall then be covered with a uniform layer of clean sand and kept thoroughly and uniformly covered by additional sand or sweeping until it shows no signs of picking up under traffic. For a period of one (1) week after priming, the CONTRACTOR shall again broom any area where insufficient cover sand or excess of bituminous material causes "bleeding" and, if necessary, spread additional sand on such area.

C. Prime Coat Finish: After prime has cured or sat and been sanded, the shoulder shall be shaped to conform to all grade lines and cross-sections and the entire area shall be rolled and compacted with a rubber-tired roller or a power roller before asphalt surface is laid on the finished base.

3.5 BITUMINOUS TACK COAT

A. Before applying any bituminous material, all loose material: dust, dirt and foreign material, which might prevent proper bond with the existing surface, shall be removed for the full width of the application.

B. Application for Tack Coat:

1. The surface to receive the tack coat shall be clean and dry. The tack coat shall be applied with a pressure distributor except that on small jobs, if approved by the ENGINEER, the application may be made by other approved mechanical methods or by hand methods. The pressure distributor shall operate at a pressure not less than 20 pounds per square inch and at a consistency such that it can be properly pumped and sprayed uniformly over the surface.
2. The bituminous material shall be applied in a thin uniform layer. The rate of application shall be approximately 0.25 gallon per square yard. The tack coat shall be applied sufficiently in advance of the laying of the wearing surface to permit drying, but shall not be applied so far in advance that it might lose adhesiveness as a result of being covered with dust or other foreign material. The tack coat surface shall be kept free from traffic until the wearing surface is laid.

3.6 ASPHALT WEARING SURFACE COURSE

A. Cleaning and Preparing Base:

1. Prior to the laying of the asphalt, the base of pavement to be covered shall be cleaned of all loose deleterious material by the use of power brooms or blowers. A tack coat shall be applied on all pavement. The tack coat shall not be applied so far in advance of laying operations as to allow shifting and sand or weather conditions to nullify its effectiveness.
2. After the surface has been thoroughly cleaned, all holes shall be filled with asphaltic concrete, if necessary, and thoroughly compacted to conform to the existing surface and to form a smooth surface.

B. Placing Asphalt Surface: The asphaltic concrete surface course shall be applied after the tack coat may be permitted a reasonable time for drying but not to an extent that the tack coat is allowed to lose its adhesiveness.

1. Machine Spreading: Upon arrival the mixture shall be dumped into the approved mechanical spreader and immediately spread and struck off to the full width required and to such appropriate loose depth for each successive course that when the work is completed the required weight of the mixture per square yard or the specified thickness will be secured. An excessive amount of mixture shall be carried ahead of the screen at all times. Hand raking shall be done behind the machine as required.
2. Hand Spreading: In limited areas where, on account of irregularities or unavoidable obstacles, the use of mechanical spreading and finishing equipment is impractical, the mixture may be spread by hand, when so authorized by the ENGINEER.
3. The mixture shall be laid only when the surface to be covered is dry and only when weather conditions are suitable.
4. All structures which will be in actual contact with asphaltic mixture, including the face or surface of curbs or gutters and their vertical faces of existing pavements, shall be painted with a uniform coating of asphalt material to provide a closely bonded, watertight joint.
5. Where necessary, due to the traffic requirements, the mixture shall be laid in strips in such manner as to provide for the passage of traffic.
6. Any mixtures caught in transit by a sudden rain may be laid at the CONTRACTOR's risk. In no case shall the mixture be laid while rain is falling or when there is water on the surface to be covered.
7. The depth of the layer being spread shall be gauged as directed, and where the thickness fails to average the specified thickness, immediate steps shall be taken to correct the depth.
8. Before any rolling is started, the course surface shall be checked, any inequalities adjusted, and all drippings, fat sand accumulations from the screed and fat spots from any source shall be removed and replaced with satisfactory material.
9. Straight-edging and back-patching shall be done after initial completion has been obtained and while the material is still hot. Any irregularity greater than 1/4" either longitudinally or traversely shall be corrected at this time.
10. No skin patching shall be done. When a depression is to be corrected while the mixture is hot, the surface shall be well scarified before the addition of fresh mixture. If irregularities occur and are not corrected while the mixture is still hot, the irregularities shall be cut out the full depth of the layer and replaced with fresh mixture.

C. Compacting Mixture: After the spreading, the mixture shall be rolled when it has set sufficiently or come to the proper condition to be rolled, and when the rolling does not cause undue displacement or shoving.

1. The motion of the roller shall at all times be slow enough to avoid displacement and shall at once be corrected by the use of rakes and fresh mixture where required. The

rolling shall include all transverse, longitudinal, and diagonal rolling, as may be necessary to obtain the maximum density.

2. The seal rolling with tandem steel rollers weighing from five (5) to eight (8) tons shall follow as close behind the spreader as is possible without picking up, or displacing or blistering the material.
3. Rolling with the self-propelled pneumatic-tired rollers shall follow as soon as possible and as close behind the seal rolling as the heat of the mixture will permit. The rolling shall be done while pavement temperature is between 175o and 240oF, and to such an extent that the self-propelled traffic roller shall cover every area of the surface with at least ten (10) passes. Final rolling with tandem steel rollers shall be done after the rolling with self-propelled pneumatic tired rollers is completed. This final rolling shall be done before the pavement temperature is lower than 175oF, and shall be continued until all roller marks or tire marks are eliminated.
4. Self-propelled pneumatic rollers shall be used for the rolling of patching and leveling courses. At the option of the CONTRACTOR, a steel-wheeled roller may be used to supplement the self-propelled pneumatic-tired rollers but not more than one steel-wheeled roller may be used in conjunction with the necessary number of self-propelled pneumatic-tired rollers. After final completion, the finished pavement shall at no point have a density less than 95% of the laboratory compacted density.
5. Rolling with the self-propelled pneumatic-tired roller shall proceed at a speed from six (6) to twelve (12) miles per hour and the rate of rolling shall not exceed 3,000 square yards per hour per roller. A sufficient number of self-propelled pneumatic-tired rollers shall be used so that the rolling of the surface for the required number of ten (10) passes within this maximum rolling rate shall not delay any other phase of the placing operation and not result in excessive cooling of the mixture before the rolling is complete. In the event that the rolling is not properly maintained to schedule as outlined above, the laying operation shall be discontinued until the rolling operations are sufficiently caught up.
6. In all places inaccessible to a roller, such as adjacent to curbs, headers, gutters, manholes, etc., the required compaction shall be secured with tamps. Depressions which may develop before the completion of the rolling shall be remedied by loosening the mixture laid and adding new material to bring such depressions to a true surface.
7. Should any depressions remain after final compaction has been obtained, the mixture shall be removed sufficiently and new material added to form a true and even surface. All high spots, high joints and honeycombs shall be adjusted as directed by the ENGINEER.
8. The mixture, after compaction, shall be of the thickness shown on the plans. The surface, after compaction, at no place shall snow an excess of asphalt and any area showing such excess or other defect, shall be cut out and replaced with fresh mixture and immediately compacted to conform with the surrounding area. Any mixture which becomes loose or broken, mixed with dirt in the wearing course shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with surrounding areas.
9. Gasoline or oil from rollers shall not be allowed to deposit on the pavement and any pavement damaged by such deposits shall be removed and replaced as directed by the ENGINEER.
10. Any mixture remaining unbonded after rolling shall be removed and replaced.

D. Protection of Pavement: After the completion of the pavement, no vehicular traffic of any kind shall be permitted on the pavement until it has set sufficiently as approved by the ENGINEER.

3.7 ABUTTING EXISTING PAVING

A. Meet elevation of existing paving and structures, facilities and utilities where applicable by feathering the thickness of the new surface course for not more than one (1) foot in the periphery of the structure, facility or utility. Do not cover access covers, manhole tops, water meters or other similar devices.

3.8 PAVEMENT EDGES

A. Make edges of paved area conform to details and Sections as shown on drawings.

3.9 SEAL COATING

A. Preparation of Surface: Pavement to be sealed must be sound and free of loose dust, dirt, stones, or other foreign matter:
   1. Repair any breaks or holes.
   2. Scrape off accumulations of oil or fuel drippings and scrub with detergent and water. Remove all traces of detergent.
   3. Soft or damaged spots must be repaired.
   4. Flush entire area with clean water.
   5. Pavement should be damp (no puddles or excess water) when seal coating is applied.

B. MIXING: Stir seal coating to a uniform consistency, use no solvents for thinning. Dilute seal coating with ten (10) percent to twenty (20) percent clean water, stirring to uniform consistency.

C. Application:
   1. Seal coat may be applied to dampened surface with a rubber squeegee, soft bristled push broom, or approved mechanized equipment.
   2. Seal coating may be poured directly onto pavement in a ribbon or windrow. Squeegee is placed on pavement at a slight angle to edge line of pavement and pulled in a window along pavement in parallel lines, always working excess material toward bottom edge of squeegee.
   3. Seal coating should be applied in two (2) thin coats. After first coat is completely dry to touch, a second coat may be applied at right angles to the first. Rate of application will depend on porosity of surface.
   4. Allow to cure for twenty-four (24) hours before opening to traffic.
   5. Do not apply seal coating when temperature is below 50oF, before sealer is dry, or rain appears imminent or forecast.
   6. Apply in strict accord with manufacturers published instructions.

3.10 FIELD QUALITY CONTROL

A. Test in place asphalt course for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by ENGINEER.

1. In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:
   a. Base Course: Not greater than 1/2" of specified thickness.
   b. Surface Course: Not greater than 1/4" of specified thickness.

2. Test finished surface of each asphalt concrete course for smoothness, using ten (10) foot straight edge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.
   a. Base Course Surface: 1/4".
   b. Wearing Course Surface: 1/8".

B. Check surface area at intervals as directed by the ENGINEER.

C. Finish grade shall be within +0.05 feet of the grades indicated on the plans.

3.11 CLEAN UP

A. Remove all debris and excess material immediately from project site.

B. Take down all barricades and temporary traffic markers, signals and signs only after all work included in this Section is finished and inspected, and only after so directed by the ENGINEER.

C. Leave project area clean, orderly and free of any hazardous conditions.

3.12 CONSTRUCTION OF SWALES

A. This work consists of regrading existing swales and construction of new swales adequate for conveying storm water along the right-of-way to catch basins. The swale shall be shaped according to the cross-section shown on the plan. In areas adjacent to existing roadways all swales shall be regraded to match their existing condition prior to construction, unless otherwise noted.

B. Requirements: All soft and yielding material and other portions of the swale which will not compact readily shall be removed and replaced with suitable material and the entire swale area brought to the proper grade. Stumps, roots, and other deleterious organic matter encountered during the shaping for the swale shall be removed.

C. The bottom of all excavated areas and the top of all fills of swale areas shall be thoroughly compacted by rolling. Water shall be used as necessary to insure thorough compaction. The stability of the top twelve (12) inch thickness of swale area shall be at least fifty (50) PSI as determined by the Florida Bearing Value Method. Sufficient stabilizing material shall be added to swale area soil as required to provide the specified stability.

D. The CONTRACTOR shall place sod over existing areas damaged by construction. The sod shall match the existing sod type in the affected areas.

END OF SECTION - 321000

SECTION 321123 – ASPHALT TENNIS COURT SURFACE COLOR COATING SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Asphalt tennis court surface color coating system.

1.2 REFERENCE STANDARDS

A. American Sports Builders Association (ASBA).

B. United States Tennis Association (USTA) Rules of Tennis.

C. International Tennis Federation (ITF).

1.3 SUBMITTALS

A. Comply with Section 01330 (01 33 00) – Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including surface and crack preparation and application instructions.

C. Samples: Submit manufacturer's color samples of color coating.

D. Test Reports:
   1. Submit independent test results for solar reflectance index.
   2. Submit independent test results for 2000 Hour ASTM G154, accelerated weathering UV test, to demonstrate long-term durability and fade resistance.
   3. Submit independent test results for 2000 Hour, accelerated weathering ASTM G155 Xenon Arc test, to demonstrate long-term fade resistance and quality of pigment.

E. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

F. Manufacturer's Project References: Submit manufacturer's list of successfully completed asphalt tennis court surface color coating system projects, including project name, location, and date of application.

G. Applicator’s Project References: Submit applicator’s list of successfully completed asphalt tennis court surface color coating system projects, including project name, location, type and quantity of color coating system applied, and date of application.

H. Warranty Documentation: Submit manufacturer’s standard warranty.

I. Authorized Installer Certificate: Submit manufacturer’s authorized installer certificate.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:
   1. Manufacturer regularly engaged, for past 5 years, in manufacture of asphalt tennis court surface color coating systems of similar type to that specified.
   2. United States owned company.
   3. Member: ASBA.
   4. Manufacturer has surfaces that are classified by the ITF’s (International Tennis Federation) pace classification program.

B. Applicator's Qualifications:
   1. Applicator regularly engaged, for past 3 years, in application of tennis court surface color coating systems of similar type to that specified.
   2. Employ persons trained for application of tennis court surface color coating systems.
   3. Applicator must be authorized installer of the surfacing brand used.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance 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 application.
   3. Store materials in clean, dry area indoors.
   4. Store materials out of direct sunlight.
   5. Keep materials from freezing.
   6. Protect materials during storage, handling, and application to prevent contamination or damage.
   7. Close containers when not in use.

8. Retain manufacturer batch codes on each container and application dates, for warranty purposes.

1.6 AMBIENT CONDITIONS

A. Do not apply asphalt tennis court surface color coating system when air or surface temperatures are below 50°F (10°C) during application or within 24 hours after application.

B. Do not apply asphalt tennis court surface color coating system when rain is expected during application or within 24 hours after application.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. SportMaster Sport Surfaces, PO Box 2277, 2520 South Campbell Street, Sandusky, Ohio 44870. Toll Free 800-326-1994. Fax 877-825-9226. Website: www.sportmaster.net. E-mail moreinfo@sportmaster.net.

All other brands must be pre-approved by the architect/owner, 7 days prior to the bid date. If submitting another brand, bidder must furnish copies of all submittal documents under section 1.4

2.2 MATERIALS

A. Asphalt Tennis Court Surface Color Coating System: SportMaster Color Coating System.

B. Crack Sealant: SportMaster “Crack Magic”.
   1. 100 percent acrylic emulsion elastomeric crack sealant.
   2. Seals cracks up to 1/2 inch wide in asphalt pavement.
   3. Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.
   4. Non-Volatile Material: 61 percent, plus or minus 5 percent.
   5. Color: Provide manufacturer’s recommendations based on design and existing conditions.

C. Crack Filler: SportMaster “Acrylic Crack Patch”.
   1. 100 percent acrylic emulsion trowel-grade crack filler.
   2. Fills cracks in asphalt pavement up to 1 inch wide.
   3. Chemical Characteristics, by Weight, Minimum:
      a. Acrylic Emulsion: 10.0 percent.
      b. Hiding Pigment: 0.2 percent.
      c. Mineral Inert Fillers: 78.0 percent.

d. Film Formers, Additives: 1.8 percent.
e. Water: 8.5 percent.

4. Weight per Gallon at 77 Degrees F: 15.2 lbs., plus or minus 1.0 lbs.
5. Non-Volatile Material: 80 percent, plus or minus 5 percent.
6. Color: Provide manufacturer's recommendations based on design and existing conditions.

D. Patch Binder: SportMaster "Acrylic Patch Binder".
1. 100 percent acrylic emulsion liquid binder.
2. Mix on-site with sand and cement.
3. Levels and repairs low spots and depressions up to 3/4 inch deep in asphalt pavement.
4. Fills Cracks in Asphalt up to 1" in width.
5. Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.

E. Filler Course: SportMaster "Acrylic Resurfacer".
1. 100 percent acrylic emulsion resurfacer.
2. Mix on-site with silica sand.
3. Apply to asphalt surfaces or previously colored acrylic surfaces in preparation of color coating system.
4. Chemical Characteristics, by Weight, Minimum:
a. Acrylic Emulsion: 44.0 percent.
b. Hiding Pigment: 2.0 percent.
c. Mineral Inert Fillers: 5.0 percent.
d. Film Formers, Additives: 0.2 percent.
e. Water: 45.0 percent.
5. Weight per Gallon at 77 Degrees F: 8.5 lbs., plus or minus 0.5 lbs.
6. Non-Volatile Material: 27.5 percent, plus or minus 5.0 percent.
7. Color: Provide manufacturer's recommendations based on design and existing conditions

F. Color Coating: SportMaster "ColorPlus System".
1. 100 percent acrylic emulsion coating.
2. Mix on-site with silica sand and water.
3. Color coats tennis and multipurpose courts.
4. Weight per Gallon at 77 Degrees F: 9.2 lbs., plus or minus 0.5 lbs.
5. Color: Dove Gray and Ice Blue per the plans

G. Line Markings Primer: SportMaster "Stripe-Rite".
1. 100 percent acrylic emulsion primer, clear drying.
2. Primes line markings and prevents bleed-under for sharp lines.
3. Chemical Characteristics, by Weight, Nominal:
a. Acrylic Emulsion: 38.0 percent.
b. Hiding Pigment: 0.0 percent.
c. Mineral Inert Fillers: 7.0 percent.
d. Film Formers, Additives: 1.5 percent.

e. Water: 50.0 percent.

4. Weight per Gallon at 77 Degrees F: 8.9 lbs., plus or minus 0.5 lbs.
5. Non-Volatile Material: 29 percent, plus or minus 5 percent.

H. Line Paint: SportMaster "Textured Line Paint".
1. Pigmented, 100 percent acrylic emulsion line paint.
2. Line marking on asphalt tennis courts.
3. Chemical Characteristics, by Weight, Nominal:
a. Acrylic Emulsion: 25.89 percent.
b. Pigment: 14.90 percent.
c. Mineral Inert Fillers: 13.12 percent.
d. Additives: 4.73 percent.
e. Water: 41.36 percent.
4. Weight per Gallon at 77 Degrees F: 10.65 lbs., plus or minus 0.75 lbs.
5. Non-Volatile Material: 45.17 percent, plus or minus 5 percent.
6. Color: White.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine asphalt tennis court surfaces to receive color coating system.

B. Verify asphalt tennis courts meet ASBA construction requirements.

C. Notify Architect of conditions that would adversely affect application or subsequent use.

D. Do not begin surface preparation or application until unacceptable conditions are corrected.

3.2 SURFACE PREPARATION

A. Protection of In-Place Conditions: Protect adjacent surfaces and landscaping from contact with asphalt tennis court surface color coating system.

B. Prepare surfaces in accordance with manufacturer's instructions.

C. Cure new asphalt surfaces a minimum of 14 to 30 days before application of asphalt tennis court surface color coating system.

D. Remove dirt, dust, debris, oil, grease, vegetation, loose materials, and other surface contaminants which could adversely affect application of asphalt tennis court surface color coating system. Pressure wash entire surface.

E. Repair cracks, depressions, and surface defects in accordance with manufacturer's instructions before application of filler course and color coating.

F. Level depressions 1/8 inch and deeper with patch binder in accordance with manufacturer's instructions.

G. Apply 1 or 2 coats of filler course as required by surface roughness and porosity to provide smooth underlayment for application of color coating.

H. Ensure surface repairs are flush and smooth to adjoining surfaces.

3.3 APPLICATION

A. Apply asphalt tennis court surface color coating system in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Mix materials in accordance with manufacturer's instructions.

C. Apply Filler Course and Color Coating with a 50-60 durometer, soft rubber squeegee.

D. Filler Course:
   1. Apply 2 coats on new asphalt or existing acrylic surfaces with extensive cracks or low spot repair.
   2. Apply 1 coat on existing acrylic surfaces with minimal repairs.

E. Color Coating: Apply a minimum of 2 coats of color coating to prepared surfaces in accordance with manufacturer's instructions.

F. Allow material drying times in accordance with manufacturer's instructions before applying other materials or opening completed surface to foot traffic.

3.4 LINE MARKINGS

A. Lay out tennis court line markings in accordance with USTA Rules of Tennis.

B. Apply line markings primer, after masking tape has been laid, to seal voids between masking tape and tennis court surface to prevent bleed-under when line paint is applied.

C. Apply a minimum of 1 coat of line paint in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Allow a minimum of 24 hours curing time before opening tennis courts for play.

B. Protect applied asphalt tennis court surface color coating system to ensure that, except for normal weathering, coating system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 321723 - PAVEMENT MARKING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All applicable provisions of the bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this Section.

1.2 WORK INCLUDED

A. The work covered by this Section shall include the furnishing of all labor, equipment and materials necessary to construct and install all pavement marking and striping in accordance with the plans and these specifications.

1.3 QUALITY ASSURANCE

A. Perform all work in accordance with the requirements of local agencies.

1.4 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

PART 2 – PRODUCTS

2.1 Chlorinated rubber-alkyd type, as per Fed Spec. No. TT-P-115, Type III, or shall be Code T-1, conforming to Section 971-12.2 of the Florida Department of Transportation Standard Specifications.

A. Paint shall be factory mixed, quick drying and non-bleeding type.

B. Color shall be as per D.O.T. requirements.

C. Striping, arrows and lane markers shall be provided with paint containing reflective additive.

2.2 Thermoplastic paint shall conform to the applicable Technical Specifications (Section 711) of the Florida Department of Transportation and City of Delray Beach Standards.

2.3 Traffic paint shall conform to the applicable Technical Specifications (Section 710) of the Florida Department of Transportation and City of Delray Beach Standards.

2.4 Reflectors shall be in accordance with City of Delray Beach Minimum Standards.

PART 3 - EXECUTION

3.1 TRAFFIC AND LANE MARKINGS

A. Sweep dust and loose material from the sealed surface.

B. Apply paint striping as required, with suitable mechanical equipment to produce uniform straight edges.

C. Protect pavement markings until completely dry in accordance with manufacturers recommendations.

END OF SECTION - 321723

SECTION 321726 - TACTILE WARNING SURFACING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 Specifications Section, apply to this Section.

1.2 DESCRIPTION

A. This Section specifies furnishing and installing cast-in-place tactile tile modules where indicated.

1.3 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.

B. Samples for Verification Purposes: Submit two (2) tile samples minimum 6"x8" of the kind proposed for use.

C. Shop drawings are required for products specified showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.

D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on a cast-in-place tactile tile system as certified by a qualified independent testing laboratory.

E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.

1.5 QUALITY ASSURANCE

A. Provide cast-in-place tactile tiles and accessories as produced by a single manufacturer.

B. Installer's Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for this project.

C. Americans with Disabilities Act (ADA): Provide tactile warning surfaces which comply with the Detectable Warnings on Walking Surfaces section of the Americans with Disabilities Act.

D. Vitrified Polymer Composite (VPC) cast-in-place tiles shall be an epoxy polymer composition with an ultraviolet stabilized coating employing aluminum oxide particles in the truncated domes. The tile shall incorporate an in-line dome pattern of truncated domes in accordance with latest ADA specifications.

1. Dimensions: Tile Assemblies shall be held within the following dimensions and tolerances:

Length and Width	:	Varies
Depth	:	1.400" +5% max.
Face Thickness	:	0.1875 +5% max.
Warpage of Edge	:	+0.5% max.

2. Water Absorption of Tile when tested by ASTM-D 570 not to exceed 0.35%.
3. Slip Resistance of Tile when tested by ASTM-C 1028 the combined wet/dry static co-efficient of friction not to be less than 0.90 on top of domes and field area.
4. Compressive Strength of tile when tested by ASTM-D 695-91 not to be less than 18,000 psi.
5. Tensile Strength of Tile when tested by ASTM-D 638-91 not to be less than 10,000 psi.
6. Flexural Strength of Tile when tested by ASTM-C 293-94 not to be less than 24,000 psi.
7. Chemical Stain Resistance of Tile when tested by ASTM-D 543-87 to withstand without discoloration or staining - 1% hydrochloric acid, urine, calcium chloride, stamp pad ink, gum and red aerosol paint.
8. Abrasive Wear of Tile when tested by BYK - Gardner Tester ASTM-D 2486* with reciprocating linear motion of 37+ cycles per minute over a 10" travel. The abrasive medium, a 40 grit Norton Metallite sand paper, to be fixed and leveled to a holder. The combined mass of the sled, weight and wood block to be 3.2 lb. Average wear depth shall not exceed 0.030 after 1000 abrasion cycles measured on the top surface of the dome representing the average of three measurement locations per sample.
9. Fire Resistance: When tested to ASTM E84 flame spread by less than 25.
10. Gardner Impact to geometry "GE" of the standard when tested by ASTM-D 5420-93 to have a mean failure energy expressed as a function of specimen thickness of

not less than 450 in. 1bf/in. A failure is noted if a hairline fracture is visible in the specimen.

E. Accelerated Weathering of Tile when tested by ASTM-G26-95 for 2000 hours shall exhibit the following result - no deterioration, fading or chalking of surface of tile.

F. Vitrified Polymer Composite (VPC) Cast-In-Place Tiles embedded in concrete shall meet or exceed the following test criteria:

1. Accelerated Aging and Freeze Thaw Test of Tile when tested to ASTM-D 1037 shall show no evidence of cracking, delamination, warpage, checking, blistering, color change, loosening of tiles or other defects.
2. Salt and Spray Performance of Tile and Adhesive System when tested to ASTM-B 117 not to show any deterioration or other defects after 100 hours of exposure.

1.6 DELIVERY, STORAGE AND HANDLING

A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings and tile type shall be identified by part number.

1.7 SITE CONDITIONS

A. Environmental Conditions and Protection: Maintain minimum temperature of 40 degrees F in spaces to receive tactile tiles for at least 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40 degrees F in areas where work is completed.

B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.

C. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal, state and local laws and ordinances.

D. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.

1.8 EXTRA STOCK

A. Deliver extra stock to storage area designated by ENGINEER. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for cast-in-place tactile tiles. Furnish not less than two (2) % of the supplied materials for each type, color and pattern installed.

1.9 GUARANTEE

A. Cast-in-place tactile tiles shall be guaranteed in writing for a period of five years from date of final completion. The guarantee includes defective work, breakage, deformation, and loosening of tiles.

PART 2 – PRODUCTS

1.1 MANUFACTURERS

A. Available Manufacturers: Manufacturers offering products that may be incorporated in the Work are Subject to compliance with requirements,

PART 3 – EXECUTION

3.1 INSTALLATION

A. During all concrete pouring and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

B. The specifications of the concrete sealants and related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers.

C. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Cast-In-Place Tile System. An overly wet mix will cause the Cast-In-Place system to float, therefore, under these conditions suitable weights such as 2 concrete blocks or sandbags (25 lb) shall be placed on each tile.

D. Prior to placement of the Cast-In-Place System, the contract drawings shall be reviewed.

E. The concrete pouring and finishing operations require typical mason's tools, however, a 4' long level with electronic slope readout, 25 lb. weights, vibrator and small sledge hammer with 2" x 6" x 20" wood tamping plate are specific to the installation of the Cast-In-Place System.

F. The concrete shall be poured and finished, true and smooth to the required dimensions and slope prior to tile placement. Immediately after finishing the concrete, the electronic level should be used to check that the required slope is achieved. The tile shall be placed true and square to the curb edge in accordance with the contract drawings. The Cast-In-Place Tiles shall be tamped or vibrated into the fresh concrete to ensure that the field level of tile is flush to the adjacent concrete surface. The contract drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes. The tolerance for elevation differences between tile and adjacent surface if 1/16".

G. Immediately after tile placement, the tile elevation is to be checked to adjacent concrete. The tile elevation and slope should be set consistent with contract drawings to permit water drainage to curb as the design dictates.

H. While concrete is workable a steel trowel shall be used to trowel the concrete around the tile perimeter to the field level of the tile.

I. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external forces placed on the tile to rock the tile, causing a void between the underside of the tile and concrete.

J. Following tile placement, review installation tolerances to contract drawings and adjust tile before the concrete sets, 2 suitable weights of 25 lb. each shall be placed on each tile as necessary to ensure solid contact of tile underside of concrete

K. Following the curing of the concrete, the protective plastic wrap is to be removed form the tile face by cutting the plastic with a sharp knife tight to the concrete/tile interface. If concrete bleeding occurs, a wire brush will clean the residue without damage to the tile surface.

3.2 CLEANING AND PROTECTING

A. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specification.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

C. Clean tactile tiles not more that four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by method specified by tactile tile manufacturer.

END OF SECTION - 321726

SECTION 321824 – ASPHALT BASKETBALL COURT SURFACE COLOR COATING SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Asphalt basketball & multi-purpose court surface color coating system.

1.2 REFERENCE STANDARDS

A. American Sports Builders Association (ASBA).

B. United States Tennis Association (USTA) Rules of Tennis.

C. National Basketball Association (NBA) Official Rules

D. National Federation of State High School Associations (NFHS) Rule Book

E. National Collegiate Athletic Association (NCAA) Rule Book

1.2 SUBMITTALS

A. Comply with Section 01330 (01 33 00) – Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including surface and crack preparation and application instructions.

C. Samples: Submit manufacturer's color samples of color coating.

D. Test Reports:
1. Submit independent test results for solar reflectance index.
2. Submit independent test results for 2000 Hour ASTM G154, accelerated weathering UV test, to demonstrate long-term durability and fade resistance.
3. Submit independent test results for 2000 Hour, accelerated weathering ASTM G155 Xenon Arc test, to demonstrate long-term fade resistance and quality of pigment.

E. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

F. Manufacturer’s Project References: Submit manufacturer’s list of successfully completed asphalt basketball & multi-purpose court surface color coating system projects, including project name, location, and date of application.

G. Applicator’s Project References: Submit applicator’s list of successfully completed asphalt basketball & multi-purpose court surface color coating system projects, including project name, location, type and quantity of color coating system applied, and date of application.

H. Warranty Documentation: Submit manufacturer’s standard warranty.

I. Authorized Installer Certificate: Submit manufacturer’s authorized installer certificate.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:
1. Manufacturer regularly engaged, for past 5 years, in manufacture of asphalt basketball & multi-purpose court surface color coating systems of similar type to that specified.
2. United States owned company.
3. Member: ASBA.

B. Applicator's Qualifications:
1. Applicator regularly engaged, for past 3 years, in application of basketball & multi-purpose court surface color coating systems of similar type to that specified.
2. Employ persons trained for application of basketball & multi-purpose court surface color coating systems.
3. Applicator must be authorized installer of the surfacing brand used.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance 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 application.
3. Store materials in clean, dry area indoors.
4. Store materials out of direct sunlight.
5. Keep materials from freezing.

6. Protect materials during storage, handling, and application to prevent contamination or damage.
7. Close containers when not in use.
8. Retain manufacturer batch codes on each container and application dates, for warranty purposes.

1.5 AMBIENT CONDITIONS

A. Do not apply asphalt basketball & multi-purpose court surface color coating system when air or surface temperatures are below 50°F (10°C) during application or within 24 hours after application.

B. Do not apply asphalt basketball & multi-purpose court surface color coating system when rain is expected during application or within 24 hours after application.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. SportMaster Sport Surfaces, PO Box 2277, 2520 South Campbell Street, Sandusky, Ohio 44870. Toll Free 800-326-1994. Fax 877-825-9226. Website www.sportmaster.net. E-mail moreinfo@sportmaster.net.

All other brands must be pre-approved by the architect/owner, 7 days prior to the bid date. If submitting another brand, bidder must furnish copies of all submittal documents under section 1.4

2.2 MATERIALS

A. Asphalt Basketball & Multi-Purpose Court Surface Color Coating System: SportMaster Color Coating System.

B. Crack Sealant: SportMaster “Crack Magic”.
1. 100 percent acrylic emulsion elastomeric crack sealant.
2. Seals cracks up to 1/2 inch wide in asphalt pavement.
3. Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.
4. Non-Volatile Material: 61 percent, plus or minus 5 percent.

C. Crack Filler: SportMaster “Acrylic Crack Patch”.
1. 100 percent acrylic emulsion trowel-grade crack filler.
2. Fills cracks in asphalt pavement up to 1 inch wide.
3. Chemical Characteristics, by Weight, Minimum:

a. Acrylic Emulsion: 10.0 percent.
b. Hiding Pigment: 0.2 percent.
c. Mineral Inert Fillers: 78.0 percent.
d. Film Formers, Additives: 1.8 percent.
e. Water: 8.5 percent.

4. Weight per Gallon at 77 Degrees F: 15.2 lbs., plus or minus 1.0 lbs.
5. Non-Volatile Material: 80 percent, plus or minus 5 percent.
6. Color: Provide manufacturer's recommendation for review

D. Patch Binder: SportMaster "Acrylic Patch Binder".
1. 100 percent acrylic emulsion liquid binder.
2. Mix on-site with sand and cement.
3. Levels and repairs low spots and depressions up to 3/4 inch deep in asphalt pavement.
4. Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.

E. Filler Course: SportMaster "Acrylic Resurfacer".
1. 100 percent acrylic emulsion resurfacer.
2. Mix on-site with silica sand.
3. Apply to asphalt surfaces or previously colored acrylic surfaces in preparation of color coating system.
4. Chemical Characteristics, by Weight, Minimum:
a. Acrylic Emulsion: 44.0 percent.
b. Hiding Pigment: 2.0 percent.
c. Mineral Inert Fillers: 5.0 percent.
d. Film Formers, Additives: 0.2 percent.
e. Water: 45.0 percent.
5. Weight per Gallon at 77 Degrees F: 8.5 lbs., plus or minus 0.5 lbs.
6. Non-Volatile Material: 27.5 percent, plus or minus 5.0 percent.
7. Color: Black or Neutral, provide manufacturer's recommendations.

F. Color Coating: SportMaster "ColorPlus System".
1. 100 percent acrylic emulsion coating.
2. Mix on-site with silica sand and water.
3. Color coats basketball & multi-purpose courts.
4. Weight per Gallon at 77 Degrees F: 9.2 lbs., plus or minus 0.5 lbs.
5. Color: Dove Gray and Ice Blue per the plans

G. Line Markings Primer: SportMaster "Stripe-Rite".
1. 100 percent acrylic emulsion primer, clear drying.
2. Primes line markings and prevents bleed-under for sharp lines.
3. Chemical Characteristics, by Weight, Nominal:
a. Acrylic Emulsion: 38.0 percent.
b. Hiding Pigment: 0.0 percent.

c. Mineral Inert Fillers: 7.0 percent.
d. Film Formers, Additives: 1.5 percent.
e. Water: 50.0 percent.

4. Weight per Gallon at 77 Degrees F: 8.9 lbs., plus or minus 0.5 lbs.
5. Non-Volatile Material: 29 percent, plus or minus 5 percent.

H. Line Paint: SportMaster "Textured Line Paint".
1. Pigmented, 100 percent acrylic emulsion line paint.
2. Line marking on asphalt basketball & multi-purpose courts.
3. Chemical Characteristics, by Weight, Nominal:
a. Acrylic Emulsion: 25.89 percent.
b. Pigment: 14.90 percent.
c. Mineral Inert Fillers: 13.12 percent.
d. Additives: 4.73 percent.
e. Water: 41.36 percent.
4. Weight per Gallon at 77 Degrees F: 10.65 lbs., plus or minus 0.75 lbs.
5. Non-Volatile Material: 45.17 percent, plus or minus 5 percent.
6. Color: White.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine asphalt basketball & multi-purpose court surfaces to receive color coating system.

B. Verify asphalt basketball & multi-purpose courts meet ASBA requirements.

C. Notify Architect of conditions that would adversely affect application or subsequent use.

D. Do not begin surface preparation or application until unacceptable conditions are corrected.

3.2 SURFACE PREPARATION

A. Protection of In-Place Conditions: Protect adjacent surfaces and landscaping from contact with asphalt basketball & multi-purpose court surface color coating system.

B. Prepare surfaces in accordance with manufacturer's instructions.

C. Cure new asphalt surfaces a minimum of 14 to 30 days before application of asphalt basketball & multi-purpose court surface color coating system.

D. Remove dirt, dust, debris, oil, grease, vegetation, loose materials, and other surface contaminants which could adversely affect application of asphalt basketball & multi-purpose court surface color coating system. Pressure wash entire surface.

E. Repair cracks, depressions, and surface defects in accordance with manufacturer's instructions before application of filler course and color coating.

F. Level depressions 1/8 inch and deeper with patch binder in accordance with manufacturer's instructions.

G. Apply 1 or 2 coats of filler course as required by surface roughness and porosity to provide smooth underlayment for application of color coating.

H. Ensure surface repairs are flush and smooth to adjoining surfaces.

3.3 APPLICATION

A. Apply asphalt basketball & multi-purpose court surface color coating system in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Mix materials in accordance with manufacturer's instructions.

C. Apply Filler Course and Color Coating with a 50-60 durometer, soft rubber squeegee.

D. Filler Course:
   1. Apply 2 coats on new asphalt or existing acrylic surfaces with extensive cracks or low spot repair.
   2. Apply 1 coat on existing acrylic surfaces with minimal repairs.

E. Color Coating: Apply a minimum of 2 coats of color coating to prepared surfaces in accordance with manufacturer's instructions.

F. Allow material drying times in accordance with manufacturer's instructions before applying other materials or opening completed surface to foot traffic.

3.4 LINE MARKINGS

A. Lay out court line markings in accordance with appropriate governing body:
   a. USTA Rules of Tennis.
   b. NBA Official Rules for professional basketball
   c. NFHS Rules for high school basketball
   d. NCAA Rules for college basketball
   e. Other required game layout

B. Apply line markings primer, after masking tape has been laid, to seal voids between masking tape and court surface to prevent bleed-under when line paint is applied.

C. Apply a minimum of 1 coat of line paint in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Allow a minimum of 24 hours curing time before opening basketball & multi-purpose courts for play.

B. Protect applied asphalt basketball & multi-purpose court surface color coating system to ensure that, except for normal weathering, coating system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 323110 – ORNAMENTAL PICKET FENCING, GATES & ACCESSORIES

PART I – GENERAL:

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

1.02 RELATED SECTIONS

A. Section 312000 – Earth Moving

B. Section 033000 - Cast in Place Concrete for Site

1.03 SECTION INCLUDES

A. Ornamental picket fencing, gates and accessories.

1.04 SUBMITTALS:

A. Layout Site Plan: Detailed Site Plan layout of fencing, gates with dimensions and grades.

B. Shop Drawings: Detailed cut sheets of fence and gates with dimensions, color/finishes of component accessories and post foundations.

C. Material Data: Manufacturer's catalogue cuts indicating material compliance and specified options.

D. Mock-up Sample: Demonstration model of specified product to include: Color, Hardware, Brackets, Finish, Welding, etc. If requested, samples of raw materials, (e.g. pickets, rails, post, hardware, caps, and accessories).

E. Warranty Data: Manufacturer's Standard Letter of Warranty

F. Installer References: Provide a minimum of five (5) project references indicating date of installation and contact information with project photos of similar manufacturing and installation practices.

1.05 QUALITY ASSURANCE

A. Contractor shall stake all column and fence locations prior to installation for final review by City and/or Landscape Architect.

B. Contractor shall notify City project representative 72 hours prior to final stakeout review. Stakeout shall only be reviewed after all submittals for columns and fencing is completed.

1.06 REFERENCES

A. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

C. ASTM D523 - Test Method for Specular Gloss.

D. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.

E. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

F. ASTM D2244 - Test Method for Calculations of Color Differences from Instrumentally Measured Color Coordinates.

G. ASTM D2794 - Test Method for Resistance of Organic Coatings to The Effects of Rapid Deformation (Impact).

H. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

1.07 SPECIAL WARRANTY

A. Provide manufacturer's standard limited warranty that its ornamental fence system is free from defects in material and workmanship including cracking, peeling, blistering and corroding for a period of 15 years from the date of purchase.

PART II - PRODUCTS

2.01 MANUFACTURER

A. Products from qualified manufacturers having a minimum of 5 years experience manufacturing ornamental picket fencing and gates will be acceptable.

2.02 ORNAMENTAL PICKET FENCE

A. Aluminum material for fence framework (i.e., tubular pickets, rails and posts) shall conform to the requirements of ASTM B221. The aluminum extrusions for posts and rails (outer channel) shall be Alloy and Temper Designation 6005-T5. The aluminum extrusions for pickets and rail inner slide channels shall be Alloy and Temper Designation 6063-T5.

B. Pickets: Square aluminum tubular members manufactured per ASTM B221, Minimum size pickets 1" square and a minimum 0.065 wall thickness extruded tubing. Space pickets a maximum face to face as specified on plans. Attach each picket to each rail with a fully-welded connection.

C. Rails: "Square" aluminum as specified on plans with a minimum wall thickness of 0.080 as per ASTM B221.

D. Posts: "Square" aluminum as specified on plans, having a minimum 0.120 wall thickness as per ASTM B221..

E. Pre-Wash Treatment: All pickets, channels, posts, fittings and accessories shall have a six-stage pretreatment/wash with zinc phosphate.

F. Finish Treatment: All pickets, channels, posts, fittings and accessories shall be polyester coated individually after drilling, welding and layout, to ensure maximum corrosion protection. All components shall be subjected to the a thermal coating process (high-temperature, in-line, multi-stage, multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be as specified on plans. The thermal coated framework shall be capable of meeting the performance requirements for each quality characteristic shown below:

1. Adhesion: ASTM D3359-Method B; Adhesion (Retention of coating) over 90% of test area (tape and knife test)

2. Corrosion Resistance: ASTM B117 & D1654; Corrosion Resistance over 3,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #6 blisters)

3. Impact Resistance: ASTM D2794; Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball)

4. Weathering Resistance: ASTM D822, D2244, D523 (60degree Method); Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units)

2.03 GATES

A. Gate Frames: Fabricate ornamental picket swing gate using aluminum members, ASTM B211. Frame members welded using weld to form rigid one-piece unit. (no substitution) Minimum size vertical uprights, 2"x2" square with a minimum 0.080 wall thickness as per ASTM B221.

B. Ornamental Picket Infill: Square aluminum tubular members manufactured per ASTM B221, Minimum size pickets 1" square and a minimum 0.065 wall thickness extruded tubing as per ASTM B221. Space pickets a maximum face to face as specified on plans. Attach each picket to each rail with a fully-welded connection.

C. Bracing: Provide diagonal adjustable length truss rods on gates to prevent sag.

D. Hinges: Structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing a minimum 180° or greater.

F. Latch: Capable of securely retaining gate in closed position and have provision for padlock.

G. Keeper: Provide keeper for each gate leaf. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.

H. Double Gates: Provide drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of latch, requiring one padlock for locking both gate leaves.

G. Pre-Wash Treatment: All pickets, channels, posts, fittings and accessories shall have a six-stage pretreatment/wash with zinc phosphate.

H. Finish Treatment: All pickets, channels, posts, fittings and accessories shall be polyester coated individually after drilling, welding and layout, to ensure maximum corrosion protection. All components shall be subjected to the a thermal coating process (high-temperature, in-line, multi-stage, multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be as specified on plans. The thermal coated framework shall be capable of meeting the performance requirements for each quality characteristic shown below:

1. Adhesion: ASTM D3359-Method B; Adhesion (Retention of coating) over 90% of test area (tape and knife test)

2. Corrosion Resistance: ASTM B117 & D1654; Corrosion Resistance over 3,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #6 blisters)

3. Impact Resistance: ASTM D2794; Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball)

4. Weathering Resistance: ASTM D822, D2244, D523 (60degree Method); Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units)

2.04 ACCESSORIES

A. Rail Attachment Brackets - die cast of Aluminum as per ASTM B221. Ball and socket design capable of 30° swivel (left/right). Bracket to fully encapsulate rail end for complete security.

B. Post Caps: Cast of aluminum alloy, weather-tight closure cap. Provide one post cap for each post as specified on plans.

2.05 SETTING MATERIAL

A. Concrete: Minimum 28 day compressive strength of 3000 psi. Size of footing as specified on plans.

PART III - EXECUTION

3.01 EXAMINATION

A. Verify areas to receive fencing are completed to final grades and elevations.

B. Ensure property lines and legal boundaries of work are clearly established.

C. Verify grade runs prior to fabrication of fence panels. Adjust length of pickets below bottom rail if necessary to meet differences in slope. Indicate within submittal shop drawings any adjustments if necessary.

3.02 INSTALLATION

A. Install fence in accordance with manufacturer's instructions.

B. Space posts uniformly as specified on plans face to face unless otherwise indicated.

C. Concrete Set Posts: Provide shop drawings for structural review by EOR.

1. Gate Posts and Hardware: Set keepers, stops, sleeves and other accessories into concrete.

D. Surface mount (wall mount) posts/panels with mounting plates where indicated

E. Check each post for vertical and top alignment, and maintain in position during placement and finishing operation.

F. Align fence panels between posts. Firmly attach rail brackets to posts with 1/4" bolt and lock nut, ensuring panels and posts remain plumb. Fasteners shall be of similar non-corrosive material as the fence panels

3.03 GATE INSTALLATION

A. Install gates plumb, level and secure for full opening without interference.

B. Attach hardware by means which will prevent unauthorized removal.

C. Adjust hardware for smooth operation.

3.04 ACCESSORIES

A. Install post caps and other accessories to complete fence.

3.05 CLEANING

A. Clean up debris and unused material, and remove from site.

END OF SECTION 323110

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.2 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of work of this section; require attendance by affected installers.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit 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.

C. Shop Drawings:

1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

2. Foundation details, concrete design mix and reinforcing schedule for anti-ram barrier system.

D. Manufacturer's Warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.7 WARRANTY

PART 2 PRODUCTS

2.1 FENCES

A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:

B. Aluminum: ASTM B221.

1. Tubular Pickets, Rails and Posts: 6005-T5 alloy.

2. Extrusions for Posts and Rails (Outer Channel): 6005-T5 alloy.

3. Extrusions for Pickets and Rail (Inner Slide Channels): 6063-T5 alloy.

C. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.

2.2 ALUMINUM FENCE

A. Decorative Aluminum Fence System: Provide fence meeting the Test Load and Coating Performance requirements of ASTM F2408 for Industrial class.

1. Fence Panels: 4 feet high by 6 feet long.

a. Panel Style: Two rail.

b. Panel Strength: Capable of supporting 270 pounds minimum load applied at midspan without deflection.

c. Attach panels to posts with manufacturer's standard panel brackets and recommended fasteners.

2. Posts: Aluminum extrusions; 2-1/2 inches square.

3. Rails: Extruded aluminum channels.

4. Pickets: Extruded aluminum tubes.

a. Style: Pickets with finial extend above top rail.

5. Fasteners: Manufacturer's standard stainless steel bolts, screws, and washers; factory finish fasteners to match fence.

6. Accessories: Aluminum castings, extrusions and cold-formed strips; factory finished to match fence.

7. Flexibility: Capable of following variable slope of up to 1:4.

8. Color: As selected by CONSULTANT from manufacturer's standard range.

B. Decorative Aluminum Post-and-Rail Fence and Swinging Gates:

1. Posts: Aluminum extrusions; 4 inches square.

2. Color: As selected by CONSULTANT from manufacturer's standard range.

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 CONSULTANT of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set fence posts in accordance with the manufacturer recommended spacing.

C. When cutting rails immediately seal the exposed surfaces by:

1. Removing metal shavings from cut area.

2. Apply zinc-rich primer to thoroughly cover cut edge and drilled hole; allow to dry.

3. Apply two coats of custom finish spray paint matching fence color.

4. Failure to seal exposed surfaces in accordance with manufacturer's instructions will negate manufacturer's warranty.

D. Space gate posts according to the manufacturers' drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected.

1. Base type and quantity of gate hinges of the application; weight, height, and number of gate cycles.

3.4 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From Indicated Position: 1 inch.

C. Minimum Distance from Property Line: 6 inches.

3.5 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

B. Clean fence with mild household detergent and clean water rinse well.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 323170– CHAIN LINK FENCING & GATES

PART I – GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

1.02 RELATED WORK

A. Section 312000 – Earth Moving

B. Section 312200 – Site Grading

C. Section 033000 - Cast-in-Place Concrete for Site

1.03 WORK INCLUDED

A. The work included in this Section consists of furnishing all labor, equipment and materials and in performing all operations necessary for installing chain link fencing, locks, and accessories. Extent of chain link fences and gates is indicated on Drawings and described in these Specifications.

1.04 QUALITY ASSURANCE

A. Chain link fencing shall be manufactured in accordance with the requirements of the CLFMI Manual. Fence manufacturer shall be a CLFMI member.

B. Fence manufacturer shall have at least ten years of experience in the manufacture of vinyl-coated steel chain link fencing.

C. The fence fabric, posts, gates, and all hardware shall be manufactured and supplied by a single manufacturer, to insure compatibility of all the fence elements and to define a single source responsibility.

1.05 SUBMITTALS

A. Shop Drawings: Show fence layout, post locations, gates, details illustrating fence height, gate width, size of posts, rails, braces, fittings, and hardware, and all footers with load calculations.

B. Product Data: Submit catalog cuts and manufacturer's detail specifications.

C. Warranty: Vinyl coated chain link fence systems shall be supplied with minimum fifteen (15) year factory warranty.

PART II - PRODUCTS

2.01 GENERAL

A. Dimensions indicated for pipe are outside dimensions, exclusive of coatings. All posts and rails shall be Schedule 40 pipe.

2.02 FENCE FABRIC

A. Fabric shall be PVC coated thermally fused and bonded to a primer which is thermally cured onto galvanized steel core wire conforming to ASTM F 668, Class 2. Minimum coating thickness shall be 0.007 in.

B. Fabric shall be woven into 1.5 in. mesh of 9 gauge galvanized wire core with a minimum breaking strength of 1,290 lbs./ft. in accordance with ASTM F 668, Class 2. Coated wire size shall be 8 gauge (0.165 in.). Other gauges may be required as noted on the plans.

C. Zinc for galvanized coating shall conform to ASTM b 6, galvanized by hot dipped method AISI Type 1, before vinyl coating; coating shall be smooth. Minimum weight of zinc coating shall be 1.2 oz. per sq. ft. (0.30 oz./ft.).

D. Polyvinyl chloride coating shall meet the following requirements:

1. Specific gravity shall be 1.30 maximum, tested in accordance with ASTM D 792.

2. Hardness shall be a minimum Durometer reading of A 95 in accordance with ASTM D 2240. Ultimate elongation shall be 275% in accordance with ASTM D 412.

3. Tensile strength shall have a test minimum of 3,300 p.s.i. in accordance with ASTM D 412.

4. Vinyl shall be a dense and impervious covering free of voids, having a smooth, lustrous surface without pinholes, bubbles, voids, or rough or blistered surface.

5. Fabric shall be furnished with salvages knuckled on both the top and bottom edges.

6. Furnish one-piece fabric widths up to 12 ft. in height.

E. Fence fabric color shall be black.

2.03 FENCE POSTS, HARDWARE, AND FITTINGS-GENERAL

A. All posts, fittings, etc. shall be PVC coated same as all fence fabric. Fittings shall be of best quality malleable iron casting, wrought iron forgings, or pressed steel and provided with pin connections. Equipment shall be designed to carry 100% overload. All fittings and accessories shall be vinyl coated with color to match fence fabric.

1. Malleable iron castings shall be hot-dipped galvanized in accordance with ASTM A 153.

2. Wrought iron forgings or pressed steel fitting and appurtenances shall be hot-dipped galvanized in accordance with ASTM A 123.

3. Fence hardware coating shall match fence fabric coating.

B. Piping shall be steel conforming to ASTM A 569 (SS40).

C. Galvanized items shall be galvanized in accordance with ASTM A 123, A 153, or A 385, as applicable.

D. Bolts which are installed 6 ft. or less above grade shall not protrude more than ¼ in. beyond the nut after tightening. Rough edges shall be filed smooth. All fittings and accessories shall be vinyl coated with color to match fence fabric.

2.04 POSTS

A. End, Corner and Pull Posts: Per the plans, provide shop drawings

B. Line Posts: Space uniformly at approximately 10’ o.c. maximum, unless otherwise indicated, of following minimum sizes and weights.

C. Special Provisions for powder coated yellow post, i.e. “Foul Pole”, refer to fencing details for location..

2.05 RAILS

A. TOP RAIL: Manufacturer’s longest length, with expansion type couplings, approximately 6” long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.

B. MID RAIL: Provide means for attaching fabric securely to each gate corner, pull and end post.

C. BOTTOM RAIL: Provide means for attaching bottom rail securely to each gate corner, pull and end post.

D. Special Provisions for powder coated yellow rail, i.e. “Home Run Line”, refer to fencing details for location.

2.06 GATES

A. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members a maximum of 8’ apart unless otherwise indicated.

Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate frame at not more than 15” o.c.

Install diagonal cross-bracing consisting of 3/8” diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

B. SWING GATES: Fabricate perimeter frames of minimum 2” OD Schedule 40 pipe, weighing 1.9 lb./ft.

C. GATE HARDWARE: Provide hardware and accessories for each gate, galvanized per ASTM a 153, and in accordance with the following:

1. Hinges: Provide 1 pair of hinges for each leaf. Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide 1 extra hinge for each leaf cover over 6" nominal height.

2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

3. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.

4. Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.

D. GATE POSTS: Furnish posts for supporting single gate leaf, or one leaf of double gate installation, for nominal gate widths.

2.07 POST CAPS

A. POST CAPS: Provide weathertight closure cap with loop to receive tension wire or top rail; one cap for each post.

2.08 TENSION WIRE

A. TENSION WIRE: 6-ga. Coated coil spring wire, metal and finish to match fabric. Locate at bottom of fabric.

2.09 WIRE TIES

A. WIRE TIES: 11-ga. Galvanized steel or 11 ga. Aluminum wire, to match fabric core material.

2.10 TENSION BARS

A. TENSION BARS: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x ¾" Provide one tension bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.

2.11 POST BRACE ASSEMBLY

A. POST BRACE ASSEMBLY: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.

2.12 CONCRETE

A. CONCRETE: Provide concrete consisting of portland cement, ASTM C 150 aggregates ASTM C 33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 3,500 p.s.i., ¾" maximum size aggregate, maximum 3" slump, and 2% to 4% entrained air.

PART III - EXECUTION

3.01 INSTALLATION

Do not begin installation and erection before final grading is completed, unless otherwise permitted.

A. EXCAVATION: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

If not indicated on drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 4 times largest cross-section of post.

B. SETTING POSTS: Center and align posts in holes 4" above bottom of excavation. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations. Unless otherwise indicated, extend concrete footings ½" above grade and trowel to a crown to shed water.

C. TOP RAILS: Run rail continuously through post caps bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.

D. CENTER/MID RAILS: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.

E. BRACE ASSEMBLIES: Install braces so posts are plumb when diagonal rod is under proper tension.

F. TENSION WIRE: Install tension wires through post cap loops before stretching fabric and tie to each post cap. Fasten fabric to tension wire using 11 ga. galvanized steel hog rings spaced 24” o.c.

G. FABRIC: Leave approximately 2” between finish grade and bottom salvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

H. TENSION BARS: Thread through or clamp to fabric 4” o.c., and secure to posts with metal bands spaced 15"o.c.

I. GATES: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

J. TIE WIRES: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

1. Tie fabric to line posts, with wire ties spaces 12” o.c.

2. Tie fabric to rails and braces, with wire ties spaced 24” o.c.

3. Tie fabric to tension wires, with hog rings spaced 24” o.c.

K. FASTENERS: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

L. TOUCH UP:

1. Following installation, scratches and marred spots in galvanized surfaces shall be power wire brushed and painted with a cold-applied galvanized paint at a rate of 2 oz. zinc per sq. ft. of surface.

2. Following installation scratches and marred spots in vinyl coated surfaces shall be field coated with a vinyl coating supplied by the fence manufacturer.

END OF SECTION 02830

SECTION 323300– SITE FURNISHINGS & AMENITIES

PART I - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

1.02 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the Site Furnishings work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

B. Including but not necessarily limited to the following:

1. Tables
2. Benches
3. Bike racks
4. Trash Receptacles
5. Score Tables
6. Bleachers
7. Home Plate
8. Pitching Rubber
9. Baseball Field Bases
10. Baseball Field Distance Signage
11. Scoreboards
12. Basketball hoop
13. Basketball support post

1.03 RELATED WORK

A. Section 033000 - Cast-in-Place Concrete for Site.

1.04 SUBMITTALS

A. Manufacturer's Data: Descriptive data of installation, methods, procedures and maintenance.

1. Guarantees and warranties of products.

B. Complete shop drawings for all items of work under this section indicating all details of fabrication and installation, including sizes, shapes, finishes, colors, thicknesses, material quality and all other related work applicable to the items of this section.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials with manufacturer's original containers or packaging, with identifying tags and labels intact and legible.

B. Upon delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that all materials are properly protected and undamaged.

C. Store and handle all materials so as to prevent soiling, damage, or deterioration. Make periodic inspections of all stored materials to assure that they remain free from damage and deterioration. Damaged products shall be rejected.

PART II – PRODUCTS

TABLES

A. Product: Aluminum Table: ADA galvanized aluminum picnic table; Dumor 72-68-1A or City approved equal.

B. Location:
1. Locations and quantities as indicated on Landscape Plan and/or as field located by the City.

BENCHES

A. Product: Outfield and Basketball Benches: 6’ backless cast bench with steel seat and both end and center armrests; Dumor 144-60 or City approved equal. Surface mount. All steel members to be coated w/ zinc rich epoxy and then finished with polyester powder coating per manufacturer’s literature. Color to be submitted for final approval by the City.

B. Location: Locations and quantities as indicated on Landscape Plan and/or as field located by the City.

C. Product: Interior Benches: 6’ cast bench with steel seat and both end and center armrests; Dumor 140-60 or City approved equal Surface mount.. All steel members to be coated w/ zinc rich epoxy and then finished with polyester powder coating per manufacturer’s literature. Color to be submitted for final approval by the City.

D. Location: Locations and quantities as indicated on Landscape Plan and/or as field located by the City.

BIKE RACKS

A. Product: Bike Rack: 2 ½” Schedule 40 Bike Rack, four peaks; Dumor 125-40 or City approved equal. Surface mount. Color to be submitted for final approval by the City.

B. Location: Locations and quantities as indicated on Landscape Plan and/or as field located by the City.

TRASH RECEPTACLES

A. Product: Site Receptacle: 32-gallon steel receptacle with shield; Dumor 148-32-SH-FTO with Shield or City approved equal. Finish to be powder coated. Color to be submitted for final approval by the City.

B. Location: Locations and quantities as indicated on Landscape Plan and/or as field located by the City.

SCORE TABLES

A. Product: Score Tables: JayPro ST75 7’-6” Score Table. To be aluminum, powder coated, color to be submitted for final approval by the City.

B. Location: Locations and quantities as indicated on Landscape Plan or as field located by the City.

BLEACHERS

A. Product: Bleachers: JayPro BLDP-421AL 21’ preferred aluminum bleacher with aluminum under structure and double foot planks. To be powder coated, color to be submitted to City for final approval

B. Location: Locations and quantities as indicated on Landscape Plan or as field located by the City.

HOME PLATE:

A. Product: Home Plate: PWAthletics Model #8501-00 Professional Style Home Plate or approved equal. To meet requirements of Little League safety rule 1.06.

B. Location: Locations and quantities as indicated on Landscape Plan including but not limited to baseball fields and bullpens.

PITCHING RUBBER

A. Product: Pitching rubber: PWAthletics Model #8510-00 4-way pitching rubber or approved equal.

B. Location: Locations and quantities as indicated on Landscape Plan including but not limited to baseball fields and bullpens.

BASEBALL FIELD BASES

A. Product: Bases: PWAthletic Model #8504-00 Dislodging Safety Base, Set of 3 or approved equal. To meet requirements of Little League safety rule 1.06.

B. Location: Locations and quantities as indicated on Landscape Plan or as field located by the City.

BASEBALL FIELD DISTANCE SIGNAGE

A. Product: Polycarbonate distance signs: To be black 16”x30” Horizontal Outfield distance sign by Baseballracks.com or approved equal. Size 14” Rockwell Extra Bold font in yellow.

B. Location: Locations and quantities as indicated on Landscape Plan

SCOREBOARDS

A. Product: Scoreboard: To be American Scoreboards Model #8349 in dark green, with top ad panel and additional ad panel support structure.

B. Location: Locations and quantities as indicated on Landscape Plan or as field located by the City.

BASKETBALL BACKBOARD

A. Product: Backboard: PWAthletic Model #18 Fan Fiberglass Backboard with stark white high gloss gel coat.

B. Location: Locations and quantities as indicated on Landscape Plan

BASKETBALL RIM

A. Product: RIM: PWAthletic Model #39 Steel Extra Heavy Duty Double Ring Goal, powder coated orange.

B. Location: Locations and quantities as indicated on Landscape Plan

BASKETBALL NET

A. Product: Net: PWAthletic Model #34 Super Nylon Net in white.

B. Location: Locations and quantities as indicated on Landscape Plan

BASKETBALL SUPPORT POST

A. Product: Support Post: PWAthletic Model #1516P Gooseneck Post powder coated 242 Sky Blue. Final color to be submitted for City Approval.

B. Location: Locations and quantities as indicated on Landscape Plan or as field located by the City.

PART III - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION

A. Provide Amenities and Furnishings as indicated and detailed on the drawings, and as per manufacturer's standard printed specifications, instructions, and recommendations.

B. Provide complete manufactured cut sheets on all manufactured items, include installation hardware and methods.

END OF SECTION 02470

SECTION 328423 – IRRIGATION

PART 1 GENERAL

1.01 SUMMARY

A. Related Sections:

1 312000 – Earth Moving - Earthwork.

2 312333 - Excavating, Backfilling, and Compaction for Utilities.

3 329300 – Planting.

4 329223 -Sodding.

5 Division 26 - Electrical.

1.02 WORK INCLUDED

A. Provide labor, materials, necessary equipment, and services to complete the underground sprinkler systems work, as indicated on the drawings and as specified, except for items indicated as not-in-contract (NIC).

B. The completed and proper construction of the landscape irrigation system shall include, but not be limited to:

1 A complete and operable system for the irrigation of areas to be landscaped on the project site.

a. Maintain operation of the remaining existing system where needed, while construction of the new system is under way.

b. Plans and specifications are intended to include items obviously necessary and requisite for the proper irrigation of the project.

c. Provide any additional labor, materials, and equipment required for a proper system.

2 For existing sites, locate, interface, and connect, where indicated, the existing system to the proposed.

3 Repair any of the existing irrigation system damaged during construction.

C. On-Site Conditions.

1 Protection of Property:

a. Preserve and protect site conditions to remain from damage due to this work. In the event damage does occur, damage shall be completely repaired to its original condition at no additional cost to the Owner.

2 Trenching:

a. Trenching or other work under the leaf canopy of trees shall be done by hand or by other methods so that no branches are damaged in any way.

b. Trenching around existing plant material shall be done by hand to minimize root disturbance.

c. Buildings, walks, walls, and other property shall be protected from damage. Open ditches left exposed shall be flagged and barricaded by approved means.

d. Restore disturbed areas to their original condition.

3 Protection and Repair of Underground Utilities:

a. Request the proper utility company to stake the exact location of any underground lines including but not limited to electric, gas, telephone service, water, and cable.

b. Take whatever precautions necessary to protect underground lines from damage. In the event damage does occur, damage shall be completely repaired to its original condition, at no additional cost to the Owner.

4 Protection of Existing Plants and Site Conditions:

c. Take necessary precautions to protect site conditions to remain. Should damages be incurred, repair the damage to its original condition at no additional cost to the Owner.

d. Any disruption or disturbance of any existing plant, tree, shrub, or turf, or any structure shall by completely restored to the satisfaction of the Owner at no additional cost to the Owner.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1 A53-96 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

2 D1785-96a Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

3 D2564-96a Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

4 D2855-96 Practice for Making Solvent-Cemented Joints With Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

1.04 SUBMITTALS

A. Submit properly identified manufacturer's literature before starting Work.

B. Submit Shop Drawings including but not limited to the following:

1 Pipe and Fittings.

2 Sprinkler Heads.

3 Swing joints.

4 Gate Valve.

5 Electric Control Valve.

6 Quick Coupling Valve

7 Drip Irrigation Valve

8 Controller.

9 Backflow Preventors.

10 Valve Boxes.

11 Pressure Relief Valve.

C. Record Drawings:

1 After completion of installation, furnish completed as-built reproducibles showing locations of sprinkler heads, valves, drains, and piping to scale, with dimensions where required or necessary.

a. Show vertical and horizontal deviations from the bid documents made during construction affecting, but not limited to, the mainline pipe, controller locations, remote control valves, quick-coupling valves, and sprinkler heads.

b. The drawing shall also indicate and show approved substitutions of size, materials, manufacturers' names, and catalog numbers.

c. Piping shall be dimensioned and drawn to scale.

d. Remote control valves and isolation valves shall have 2 measurements from fixed objects.

2 The contractor will supply one complete set of prints to be used for Record Document submittal. Transfer record documents information outlined above to these reproducible prints.

3 Furnish two copies of "as-built" drawings. These drawings shall be delivered to the Landscape Architect before his review for Substantial Completion of the work.

D. Operation and Maintenance Manuals:

1 Prepare and deliver to the Landscape Architect within ten calendar days before completion of construction a minimum of three hard cover binders with three rings containing the following information:

a. Index sheet stating the contractor address and business telephone number, list of equipment with names and addresses of local manufacturers' representatives.

b. Catalog and parts sheet on every material and equipment installed under this contract.

c. Complete operating and maintenance instructions on major equipment components.

d. Provide the Owner's maintenance personnel with instructions for major equipment and show evidence in writing to the Landscape Architect at the conclusion of the project that this service has been rendered.

e. Furnish a reduced color-coded copy of the as-built drawings laminated in plastic, and mounted inside the controller cover. Note the valve number on drawings and include same number on tag attached to valve, or engrave on outside cover of valve box.

1.05 WARRANTY

A. Fully warrant the landscape irrigation system for a period of one year after the written confirmation from the Landscape Architect that the warranty period is in effect.

B. During the warranty period, enforce manufacturer and supplier warranties. Any malfunctions, deficiencies, breaks, damage, disrepair, or installation by the contractor and his suppliers shall be immediately and properly corrected to the proper order as directed by the Owner or Landscape Architect.

C. Make full and immediate restoration for any damages caused by system malfunction at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS: Including but not limited to the following. All materials per the plans.

A. Pipe and Fittings:

1 All materials throughout the system shall be new and in working condition.

2 Underground Piping:

a. Main lines (Irrigation lines on the supply side of the system up to the zone control valves). To be PVC Class 200 SDR 21, size and quantity per the plans. Include tracer wire for entire length of mainline.

b. Lateral lines (Irrigation lines on the sprinkler head side of the system from the control valves to the sprinkler heads). To be PVC Schedule 40, size and quantity per the plans.

3 Pipe Sleeves: To be PVC Schedule 40, size and quantity per the plans.

B. Solvent Cement: Provide solvent cement as scheduled on Plans.

C. Thrust Blocks:

1 Main line piping shall have thrust blocks sized and placed according to pipe manufacturer’s recommendations and as shown on drawings.

2 Thrust blocks shall be standard concrete mix according to ASTM C150, ASTM C33, and ASTM C94 with a 28 day compressive strength of 3,000 PSI.

3 Thrust blocks shall be installed at tees, elbows, 45's crosses, reducers, plugs, caps, and valves.

4 Ensure stability of thrust blocks.

D. Sprinkler Heads:

1 Provide sprinkler heads as scheduled on Drawings.

E. Control Valve: Nibco P-619-RW. Cast iron manual control valve per the plans. Install per the plans. Quantity per the plans

F. Control Valve Box: Furnish and install at quantities per the plans.

G. Quick Coupler Valves: To be Rain Bird 44-NP 1" brass quick coupling valve with non-potable purple rubber cover. Install per the plans. Quantity per the plans.

H. Drip Irrigation Valves: To be Rain Bird LFV-075 ¾" low flow DV Valve. Install per the plans. Quantity per the plans

I. Controller: To be Rain Bird ESP-LXME-2 PRO. To include wifi module. Provide manufacturer's literature for wifi module and submit to Landscape Architect of Record and City Representative for review

1 Provide number of stations as shown in Drawings.

2 Provide complete with internal transformer.

3 Provide pump switch control circuit.

4 Install per the plans

J. Pressure Relief Valve: To be Bermad 1.5-PRV-P 1-1/2" adjustable direct acting pressure reducer. Install per the plans. Quantity per the plans.

K. Backflow Preventor: Utilize existing.

L. Solvent Cemented Joints in PVC Pipe and Fittings: According to ASTM D2855.

M. Rain Sensor/Rain Switch: Rainbird Raingauge as indicated on drawings.

N. Flow Sensor: Rainbird FS-400-P as indicated on drawings.

PART 3 EXECUTION

3.01 INSPECTION

A. Do not proceed with the work of this section until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.

3.02 INSTALLATION

A. Excavation, Placing Piping, and Backfilling:

1 Excavate trenches for underground piping to provide:

a. A minimum of 24 inches cover under pavement without pipe sleeve.

b. A minimum of 12 inches cover with pipe sleeve:

c. A minimum of 12 inches cover in landscaped areas for lateral lines 4" and under.

d. A minimum of 18 inches cover in landscaped areas for main lines.

e. A minimum of 24 inches cover in landscaped areas for main lines larger than 4".

f. The pipe and fittings shall be carefully inspected before installation of trench.

g. Rocks over 2 inches in diameter and unsuitable bearing material shall be removed from trench according to manufacturer's recommendations.

2 Backfill shall be carefully placed to avoid pipe dislocation.

a. Backfill material shall be free of rocks, stumps, roots and other unsuitable material.

b. Backfill shall be placed in six inch lifts and shall be thoroughly compacted, except in planting area where planting soil is used.

c. In planting areas, the top six inches shall be suitable planting soil.

d. Backfill under pavement or sidewalks shall be compacted to 98 percent of maximum A.A.S.H.O. T-180 density.

e. The surface of backfilled trenches shall be even with the surrounding ground surface.

3 Plant, structures and utility locations shall take precedence over sprinkler and pipe locations. The contractor shall coordinate the routing of lines and final head locations with the placement of specimen trees, shrubs and utilities.

4 After pipe has been installed and tested, cover with 3 inches of rock-free soil and backfill trenches to grade.

a. Backfill shall be tamped in place.

b. Remove from the site, materials not suitable or required for backfill.

5 Coordinate underground piping location with new tree locations and portable building locations to avoid interference.

B. Swing Joints: Install sprinkler heads on the swing joints as indicated on Drawings.

C. Threaded Joints in PVC Pipe and Fittings:

1 Use Teflon thread tape or liquid Teflon thread lubricant.

2 Do not use pipe wrenches or pump pliers on PVC pipe or fittings.

D. Sprinkler Heads:

1 Install flush with the finished grade, or as called for in Drawings.

2 Sprinkler heads located along curbs and edges of paving shall be installed 6 inches from back of curb or paving. Along roadways without curbs, sprinkler heads shall be located 18 inches from edge of pavement.

E. Controllers:

1 Equip with lighting protection and grounded to a standard 5/8" copper clad steel ground rod driven a minimum of 8 feet into the ground and clamped.

2 Surge protection of 10 OHMS or less is required. If grounding rods will not give the 10 OHMS or less, 150 feet of bare #6 wire shall be installed 8 inches to 12 inches deep into an irrigated area.

3 This wire shall be connected to the ground rod by a brass, single piece clamp.

4 Wire used to connect equipment to grounding rod shall be one size larger than largest wire used on the irrigation system at same location, and connected with a brass, single piece clamp.

F. Control Wire Installation:

1 Underground splices shall be made at electric valves in valve boxes. Solder splices and coat with elastomeric waterproof cement. Wrap with electrical tape and coat again with elastomeric waterproof cement.

2 Wire passing under existing of future paving or construction shall be encased in Schedule 40 PVC conduit extending at least 12 inches beyond edges of paving and stabilized for construction. Any wire in plant beds shall be placed in 3/4" Class 160 PVC with 18 inch minimum burial. Installation procedures shall comply with local codes.

3 Electrical connections to electrical control devices shall be made with Rainbird Pen-Tite connector or accepted equivalent.

G. VALVE AND VALVE BOX INSTALLATION

1 Gate Valves: Install as located and detailed on the drawings. Position boxes in straight line layouts.

2 Quick Coupling Valves:

a. Install on main line pipe in areas shown on the drawings.

b. The connection between the main line and quick coupler valve shall be with a threaded Schedule 40 PVC pipe and triple swing joint.

3 Control Valves:

a. Install in specified valve boxes.

b. The valve shall have 6 inches of 3/4" pea gravel installed below the bottom of the valve.

c. The valve shall be connected to the main line as shown in the details.

d. If the valve box does not extend to the base of the valve, a valve box extension shall be installed.

e. Electric control valves shall be installed where shown and grouped together where practical. Place no closer than 36 inches to walk edges, building, and walls. Placement shall neatly reflect the adjacent site geometry.

f. Adjust the valve to provide flow rate or rated operating pressure required for each sprinkler circuit.

3.03 CLEANING, TESTING, AND BALANCING

A. Before testing, thoroughly flush piping system until clean.

B. Do not cover piping system with backfill until tests are satisfactorily performed.

C. Hydrostatically test the piping system at 100 psi for 1 hour with no loss in pressure.

1 Test the piping system with plugs at swing joint and branch the locations.

2 Install swing joints after hydrostatic testing is satisfactorily performed.

D. Notify A/E 24 hours before any test and obtain acceptance of tests from A/E before covering piping.

E. Provide pattern, throw, and delivery as shown on Drawings.

F. Adjust and balance the components of the piping system to provide complete coverage with a minimum of overthrow.

G. Provide an 8" x 10" reduced laminated photocopy, inside controller box door, of the irrigation plan with color coded circuits noted in sequence equal to automatic operation.

END OF SECTION 02810

SECTION 329113 – SOIL PREPARATION

PART I - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

1.02 WORK INCLUDED

A. Provide labor, materials, necessary equipment and services to complete the soil preparation work, as indicated on the drawings, as specified herein or both.

B. Including, but not limited to:

1. Topsoil
2. Soil Conditioners
3. Sand
4. Planting Soil
5. Peat

1.03 RELATED WORK

A. Section 312000 – Earth Moving

B. Section 312200 – Site Grading

C. Section 313300 – Selective Tree & Shrub Removal

D. Section 328423 - Irrigation

E. Section 329223 - Sodding

F. Section 320190.23 – Trees & Shrub Preservation

1.04 QUALITY ASSURANCE

A. Testing Agency: Independent testing laboratory

B. Conform to the requirements of Regulatory Agencies

C. Reference standards:

D. ASTM C136 - Sieve Analysis of Soils

E. ASTM D422 - Mechanical Analysis of Soils

F. ASTM D424 - Plastic Limits of Soil

1.05 SUBMITTALS

A. Contractor shall submit all component materials including and and organic amendments to the appropriate laboratories as soon as possible, preferably within **90 days** after commencement of the project. The analysis and report for all tests will be submitted to the City. The Contractor shall not commence placing or stockpiling materials until the soils are approved. The Contractor shall be responsible for the submission of all materials for testing and payment of the lab fees.

B. Test Reports:

1. Results of topsoil analysis.

2. Results of PLANT SOIL MIX C for turf sterilization analysis.

3. Results of water analysis.

4. Results of planting soil mixes analysis.

5. Results of sub grade sand analysis.

6. Results of sub grade sand sterilization analysis.

7. Results of subgrade sand percolation.

C. Certificates:

1. Manufacturer's certification and/or testing laboratory certification that content of soil conditioners meet specification requirements.

2. Literature and proposed application rates for all Soil Amendments.

3. Literature and proposed application rates for all Herbicides and Sterilizers.

D. Samples:

1. Submit a one cubic foot sample of each planting soil mix.

2. Submit a minimum one cubic yard of turf sub grade sand.

1.06 JOB CONDITIONS

A. Protect from damage to walks, pavement, plant material, and other work or existing features.

PART II - PRODUCTS

2.01 TOPSOIL

A. Use free draining topsoil, suitable for plant growth and free from hard clods, stiff clay, hardpan, gravel, subsoil, brush, roots, refuse or other deleterious material, and of uniform quality.

B. Mechanical analysis for well graded topsoil:

Sieve Size	Percentage Passing By Dry Weight
2 inch	100
1/4 inch	90-92
No. 10	50-55
No. 40	20-25
No. 100	4-6
No. 200	0-1

Dispose of materials larger than one-half inch off the site.

C. Maximum Soluble Salts: 550 ppm.

D. Acidity: pH 6.5 to pH 7.5

E. Relative Density: 25%-50%, loose

F. Relative Permeability: 8 in/hr to 14 in/hr minimum

G. Plastic Index: 3-10

2.02 SOIL CONDITIONERS

A. Aluminum Sulfate: Manufacturer's standard commercial grade.

B. Peat: Federal Specifications Q-P-166 Type 1, Class B, Sphagnum moss.

C. Pesticides: As recommended by applicable Agricultural Public Agencies.

D. Herbicides and Sterilizers:

1. “Ronstar” pre-emergent herbicide

2. “Roundup” systemic herbicide

E. Soil Amendments:

1. Fertilizer

a. All fertilizers shall be manufactured from quality materials, be free from impurities, uniform in composition meet recognized standards for effectiveness and be free flowing and suitable for application with approved equipment.

b. All fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable state fertilizer laws, bearing the grade and the trade name of the producer.

c. Die Hard Root Reviver – Endo and Ectomycorrizal inoculant, as manufactured by Die hard, 1.800.628.6373 or City approved equal.

d. Die Hard Transplant – One Step – Endo and Ectomycorrizal inoculant, as manufactured by Die hard, 1.800.628.6373 or City approved equal.

e. Time release, Palm Mix fertilizer with minor elements or City approved equal.

f. Time release, Tree and Shrub Mix fertilizer, 6-6-6, with minor elements or City approved Equal.

g. Granular Triple Super Phosphate as manufactured by IMC. Agrico. 708.970.3000 or City approved equal.

h. Agriform Planting Tablets, 8-8-8 plus minors, as manufactured by Grace Sierra, 408.263.8080 or City approved equal.

i. Scott's Turf Starter (16-25-12) or City approved equal.

j. Wetting agent to be Terra Sorb or City approved equal.

k. Soil conditioner to be "Super Lesco Wet", as manufactured by Lesco, Inc. or City Approved Equal.

2. Water: From City irrigation wells or municipal source.

3. Sand: Clean, sharp builders sand free draining and free of substances harmful to growth of plants.

4. Peat: Florida and Canadian Peat from City approved sources.

5. Compost: from City approved source.

2.03 PLANTING SOIL MIXES:

A. Planting Soil Mixture A to be placed in St. Augustine 'Floratam' sod areas, shrub and ground cover beds and in broadleaf tree pits, both new and transplanted.

1. 20% Topsoil, 10% Peat or Compost, 70% Sand

B. Planting Soil Mixture B to be placed as backfill around the root balls of palms shall be:

1. 80% FDOT coarse sand and 20% topsoil.

C. Planting Soil Mixture C to be placed in Bermuda Tifway '419' sod areas shall be:

1. 80% sand, 20%Canadian Peat.

D. Planting Soil Mixture D to be placed as backfill around the rootball of 6 trees, shrubs or groundcovers shall be:

1. 50% sand, 40% muck, 10% Peat or compost.

E. Test pH of topsoil and planting soil mixtures. If pH is not between specified limits add approved soil conditioner/additive to bring pH within that range.

2.04 BASEBALL FIELD MATERIAL:

A. Manufacturer: Crimson Stone, Inc., 6510 Keenes Mill Road, Cottondale, AL 35453, 1-800-354-5663

B. Infield Clay

1. Infield Clay shall be 70% Ortuna sand, 30% clay and obtained from a City approved source.

2. Contractor shall provide certified laboratory sieve analysis and sample to City for approval.

3. See Section 02920-2.04 C/D for field additives.

C. Infield Additive Material

1. Crimson Stone, Ultimate I or approved equal.

a. The material shall have clean, durable particles or fragments of 5/64" minus Crimson Stone material. Z-Blend additive shall be evenly mixed throughout the material.

b. The material shall have a bulk dry specific gravity of 2.50-2.75, a bulk saturated gravity of 2.50-2.75 and an apparent specific gravity of 2.75-3.00 (ASTM C127).

c. Have a resistance to abrasion and impact grading of C and loss of 40.0 or less as determined by ASTM C131.

D. Warning Track Additive Material at Fencing

1. Crimson Stone, Ultimate II or approved equal.

a. The material shall have clean, durable particles or fragments of 5/64" minus Crimson Stone material. Z-Blend additive shall be evenly mixed throughout the material.

b. The material shall have a bulk dry specific gravity of 2.50-2.75, a bulk saturated gravity of 2.50-2.75 and an apparent specific gravity of 2.75-3.00 (ASTM C127).

c. Have a resistance to abrasion and impact grading of C and loss of 40.0 or less as determined by ASTM C131.

2.05 SAND FOR FIELD

A. Use free draining non-bleached sand, suitable for drainage and free from hard clods, stiff clay, hardpan, gravel, subsoil, brush, roots, refuse or other deleterious material, and of uniform quality and color.

B. Mechanical analysis for well graded sand: Per United States Golf Association (U.S.G.A.) Guidelines and/or approved equivalent.

C. Sand shall be Sterile. Contractor shall be responsible for sterilization by fumigation or any other approved method.

PART III – EXECUTION

3.01 INSPECTION:

A. Examine areas to receive soil preparation to assure work of other trades has been completed.

B. Verify that plants to remain undisturbed have been clearly identified and protected from injury during construction. If not, identify and protect plants to remain according to procedures set forth in Section 02950 - Trees, Plants and Groundcover.

C. Remove construction materials and debris from areas to be landscaped.

D. Do not proceed with soil preparation until unsatisfactory conditions are corrected.

3.02 PERFORMANCE:

A. Subsoil: Prepare in accordance with Section 02200 - Earthwork.

B. Placement

1. Place planting soil mixes as accepted by the City.

2. Place Planting Soil Mix A to 12" depth in shrub and ground cover beds and as backfill in broadleaf tree pits or as specified on planning details.

3. Remove rocks and other objects over 1" in diameter. Repeat procedure in the event of disturbances to fine grading after completion.

4. Smooth Planting Soil mixture to three (3) inches below top of surrounding paving, wherever planting beds abut paved surfaces.

5. Smooth Planting Soil mixture to (2") two inches below finish grade in areas to be sodded with St. Augustine 'Floratam' sod.

6. Smooth 6" of planting soil mixture to (2") two inches below finish grade above 12" sterile sand in areas to be sodded with Bermuda sod.

7. Do not compact planting soil mixture, but do wet-soak planting areas to assure proper settlement. Replace topsoil/planting soil mixture to specified grade after watering.

8. Apply pre-emergent weed control per manufacturers recommended rates of application to sterilize the soil.

3.03 CLEAN-UP:

A. Immediately clean up spills, soil and conditioners on paved and finished surface areas.

B. Remove debris and excess materials from project site immediately.

END OF SECTION 0292

SECTION 329223 – SODDING

PART I – GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

1.02 WORK INCLUDED

A. Provide labor, materials, equipment and services to complete the sodding work, as indicated on the drawings, as specified herein or both.

1.03 RELATED WORK

A. Section 312000 – Earth Moving

B. Section 212200 - Site Grading

C. Section 328423 - Irrigation

D. Section 329113 - Soil Preparation

E. Section 320190.23 – Trees & Shrub Preservation

1.04 QUALITY ASSURANCE

A. Standards: Federal Specifications (FS) O-F-241c(1), Fertilizers, Mixed, Commercial.

B. Testing Agency: Independent Testing Laboratory.

C. Regulatory Agencies: Conform to the requirements of local agricultural and governing agencies.

1.05 SUBMITTALS

A. Certificates:

1. Growers Certification:

a. Grass species, and location of field from which sod is cut.

b. Compliance certificates for quarantine restrictions.

c. Sod certification information furnished with each roll or pallet as delivered.

2. Letters of recommendation from not less than 3 owners, for whom they have performed similar sport field installations.

3. Manufacturer's certification of fertilizer and herbicide composition and proposed application rates.

4. Proposed schedule of herbicide and fertilization applications.

5. Proposed schedule of grassing.

6. Proposed schedule of mowing, including specifications for the mower to be used.

7. Sample and supplier credentials of the proposed top dressing mix.

1.06 DELIVERY, STORAGE AND HANDLING

A. City is to be notified of sod delivery 24 hours prior to delivery to allow for installation observation.

B. Deliver sod on pallets, or on rolls as appropriate by species.

C. Protect root system from exposure to wind or sun.

D. Protect sod against dehydration, contamination, and heating during transportation and delivery.

E. Sod shall be delivered no more than 36 hours after harvesting. All sod delivered shall be installed within 18 hours of delivery to the job site. Any sod not installed within 18 hours shall be rejected.

F. Keep stored sod moist and under shade, or covered with moistened burlap.

G. Do not pile sod more than 2 feet deep.

H. Do not tear, stretch, or drop sod.

1.07 JOB CONDITIONS

A. Begin installation of sod only after preceding related work is accepted.

1. Earthwork

2. Fine Grading

3. Utilities

4. Paving

5. Irrigation

B. Environmental Requirements:

1. Install sod during time period acceptable to the City.

2. Do not install sod on saturated soil.

C. Erect signs and barriers against vehicular traffic, where applicable.

D. Sod installation shall be completed not less than 60 calendar days prior to the project completion date.

1.08 GUARANTEE

A. Guarantee sod for period of twelve (12) months after date of Substantial Completion.

B. Replacement sod under this guarantee shall be guaranteed for twelve (12) months from the date of installation.

C. Repair damage to other plants during sod replacement.

D. Contractor will accept responsibility for repairs of all washouts caused by weather or irrigation run off for all areas not showing an acceptable stand of grass.

E. Contractor shall be responsible for any damaged sod caused by forklifts, tractors, trucks etc. during the placing of that sod.

PART II - PRODUCTS

2.01 SOD

A. Grass Species:

1. St. Augustine ‘Floratam’, Stenotaphrum secundatum, certified

2. Tifway ‘419’ Bermuda, Cynodon dactylon, certified

B. American Sod Producers Association (ASPA) Grade: Nursery Grown or Approved. Field grown sod is not acceptable.

C. Sod Configuration:

1. St. Augustine ‘Floratam’

a. Furnished in pads, 24” x 16” x 1-1/2”, excluding top growth and thatch.

b. Pads not stretched or broken.

c. Uniformly mowed height when harvested – 2 inches.

d. Soil shall be prepared per Section 02920 Soil Preparation.

2. Tifway ‘419’ Bermuda

a. Furnished in “Big Roll”.

b. Turf shall be harvested at a depth not less than 2”.

c. Uniformly mowed when harvested, to grower’s specifications.

d. Bermuda shall be sand grown.

e. Soil shall be prepared per Section 02920 Soil Preparation

f. All plastic netting shall be removed.

D. Inspected and found free of diseases, nematodes, pests, and pest larvae, by

entomologist of the local Agricultural agency.

E. Weeds:

1. Free of non-specified grass, nut grass or other objectionable weeds.

F. Uniform in color, leaf texture, and density.

2.02 WATER

A. Free of substances harmful to plant growth meeting requirements in Section 02920 - Soil Preparation.

2.03 HERBICIDES AND STERILIZERS

A. As recommended by local agricultural agencies to be approved by the City 6 weeks prior to execution.

PART III - EXECUTION

3.01 INSPECTION

A. Verify all subsurface disturbances (utilities, irrigation) are complete and inspected.

B. Verify that planting soil mix is installed as specified in Section 02920 - Soil Preparation.

C. Water dry soil to depth of 6 inches 48 hours before sodding.

D. Fine grading shall be approved by the City prior to the installation of all sodded areas.

3.02 INSTALLATION

A. Transplant sod within 36 hours after harvesting.

B. Sod shall be installed only upon an approved subsurface free of ruts and debris, which is graded within tolerances described in section 02210, Fine Grading.

C. Lay first row of sod in straight line.

D. Butt side and end joints.

E. Stagger end joints in adjacent rows.

F. Do not stretch or overlap rows.

G. Cut and trim sod edges at plant beds, walks, buildings or other edge areas.

H. Top Dressing

1. Upon completion of sod installation, mechanically top dress Tifway '419' Bermuda with ½" Ortona coarse sand.

2. Hard top dress St. Augustine 'Floratam" with ½" Ortona coarse sand; fill all voids between panels and at pavement edges.

I. Sprinkle sod immediately after transplanting to thoroughly water and to wash in lawn sand. Add additional sand to produce a level lawn.

J. Roll sod, with roller weighing no more than 150 lbs. per foot of roller width.

K. Water sod and soil to depth of 6 inches within four hours after rolling to bind sod to subsoil and to remove air pockets between subsoil and sod.

L. Remove netting from Big Rolls prior to installation.

M. Irrigation heads shall not be lowered to the finished grade until turf installation is complete.

3.03 LAWN ESTABLISHMENT

A. Watering:

1. Irrigate sod immediately upon planting.

2. Keep sod moist during first two weeks after planting.

After two weeks, supplement rainfall to produce a minimum of 2 inches per week.

B. Mowing:

1. St. Augustine ‘Floratam’ – shall be mowed at least 1 time per week or as necessary to maintain 2-1/2 inches in height, mow to 2 inches.

2. Tifway ‘419’ Bermuda – shall be mowed at least 2 times per week or as necessary to maintain 1-1/2 inches in height, mow to 1 inch with reel mower. Reel Mower shall be approved by City prior to first cut.

C. Contractor shall maintain all grass within the project limit within the heights specified until final Certificate of Occupancy.

D. Re-sod spots larger than 6" x 6" not having uniform stand of grass.

E. Weed Eradication: Between second and third mowing, apply herbicide uniformly at manufacturer's recommended rate to reduce weed infestation.

F. Fertilizer:

1. Immediately prior to planting, all sod areas shall be fertilized. The starter fertilizer shall be applied to the sod surface, at a rate of 176 lbs. per acre.

2. Apply fertilizer once after sodding uniformly at a rate of 20 pounds per 1,000 square feet, on a schedule, as directed by the City.

3. Care shall be taken when spreading fertilizer to insure that there are no gaps during application. The fertilizer shall be applied under favorable conditions and by such approved methods as will ensure maximum uniformity of distribution.

G. Establishment period to extend until final acceptance by the City.

3.04 CLEANING

A. Immediately clean spills from paved and finished surface areas.

B. Remove debris and excess materials from project site.

C. Dispose of protective barricades and warning signs at termination of lawn establishment.

3.05 FINAL INSPECTION AND ACCEPTANCE

A. Request final inspection for acceptance at completion.

B. Replace rejected sod area with acceptable sod within two weeks after the inspection.

END OF SECTION 02934

SECTION 329300 – PLANTING

PART 1 GENERAL

1.01 SUMMARY

1. Includes but not limited to furnishing and installing all landscape materials as described in Contract Documents.
2. Related sections include Section 329113 Soil Preparation; Section 329223, Sodding, and Section 328423, Underground Sprinklers.

1.02 SUBMITTALS

A. Samples
   1. Sample of mulch for approval prior to delivery to site.
   2. Sample of Planting Mix and manufacturer's literature of percent mixture for approval prior to delivery to site.
   3. Sample of Sodding Mix and manufacturer's literature of percent mixture for approval prior to delivery to site.

1.03 QUALITY ASSURANCE

A. Pre-Installation Meeting
   1. Meet with Landscape Architect on-site prior to commencing operations related to delivery, preparation, and installation of all plant materials.
   2. Participate in installation meetings as required.

1.04 SEQUENCING

1. Relocate existing trees in conjunction with the phasing plans. Utilize the temporary tree relocation area per the landscape plans.
2. Do not install trees, palms, shrubs, and ground cover until major construction operations are completed.
3. Install trees and palms prior to planting shrubs, ground covers, and vines.
4. Plant shrubs and vines before planting ground covers.

1.05 WARRANTY

A. Guarantee from date of Final Written Acceptance
   1. Trees and palms for one year (12 consecutive months)
   2. Shrubs, ground covers, and vines for six months
   3. Plant materials shall be robust, healthy, vigorous,and in continuous growing condition, and shall be the height, spread, and caliper indicated.
      NOTE:
      Containerized plant materials shall have been growing in the specified container size for at least two months prior to delivery to the site of the work. Plant materials that appear to the Landscape Architect to have been "moved up" to a larger container size and which do not exhibit vigorous root growth, will be rejected.

1.6 OWNER'S INSTRUCTIONS

A. Provide written instructions on maintenance requirements, from completion of guarantee period, from conclusion of Contractor's required maintenance to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

A. Plants

1. Conform to requirements of plant list/key on Construction Drawings and to the most recent publishing of "Florida Grades and Standards for Nursery Plants" for species, variety, character, and other pertinent factors including size and caliper.
2. Nomenclature -
    a. Plant names used shall conform to "Standardized Plant Names" by American Joint Committee on Horticultural Nomenclature except in cases not covered.
    b. In cases not covered, follow custom of south Florida nursery trade.
    c. Plants shall bear a tag showing the genus, species, and variety of at least 10% of each species delivered to site.
3. Quality -
    a. Plants shall be sound, healthy, vigorous, and robust, free from plant disease, insect pests or their eggs, fungi, noxious weeds, and shall have healthy, normal root systems.
    b. Container stock shall be well established and free of root-bound conditions.
    c. Do not prune plants or top trees prior to delivery.
    d. Plant materials shall be subject to approval by Landscape Architect as to size, health, quality, and character. Rejected materials shall be immediately removed from site.
    e. Bare root trees, palms, and shrubs are not acceptable, and collected specimen material shall require prior inspection and written authorization of Landscape Architect.
    f. Provide plant materials from a licensed nursery.

3. Measurements –
    a. Measure height and spread of plant materials with branches in their normal position.
    b. Measure in two directions perpendicular to one another, through the center of the plant, half way between the top and bottom of the foliage of the plant.
    c. Measurement of plant pread should be average of plant, not greatest diameter. For example, plant measuring 15 inches in widest direction and

9 inches in narrowest would be classified as plant having a 12 inch spread.

d. Measurement of height shall be the maximum average height less the immediate growth.
   (1) For trees, “immediate growth” shall mean the uppermost 12” of foliage.
   (2) Palms shall be measured from top of root ball to center height of unopened spike.
   (3) For shrubs, “immediate growth” shall mean the uppermost 4” of foliage
   (4) Measure caliper of trees DBH, at 48" above crown of root ball.
   (5) Where caliper or other dimensions of plant materials are omitted from Construction Drawings, plant materials shall be normal stock for type listed.
   (6)

g. Plant materials larger than those specified may be supplied with approval of Landscape Architect, contingent upon
   1) Complying in all other respects with this specification.
   2) Provided at no additional cost to Owner.
   3) Proportional increase in size of root ball(s).

5. Shape and Form -
   a. Plant materials shall be symmetrical or typical for variety and species and conform to measurements specified in Construction Drawings.

B. Soil Preparation - See Section 329113

C. Planting Tablets - 21 gram Agriform (20-10-5).

D. Tree Guys -
   1. Tree guyis to be installed per the plans.

E. Pre-Emergent Herbicide
   1. Approved Materials -
      a. Princept Cal 90
         Treflan
      b. Surflan
      c. Ronstar G
      d. Prometon 5PS

   2. Comply with all local, state, and federal laws related to purchase, storage, application, and disposal of pre-emergent herbicides.
   3. Contractor shall insure that ony a properly licensed individual executes all herbicide application.

G. Mulch-
1. “Florimulch”.
2. Submit sample for Landscape Architect approval prior to delivery.
3. Cypress mulch products SHALL NOT BE USED.

PART 3 EXECUTION

3.01 VERIFICATION

A. Before proceeding with work, check and verify dimensions and quantities. Report variations between Drawings and site to the Landscape Architect before proceeding with work of this Section.

B. Plant totals are for convenience of Contractor only and are not guaranteed. Verify quantities as shown on Construction Drawings.

3.02 PREPARATION

A. Protection -
1. Take care and preparation in work to avoid conditions which will create hazards. Post signs or barriers as required.
2. Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.

B. Layout
1. Identify and clearly mark individual tree and palm locations, and areas for multiple plantings of shrubs and ground cover. Stake locations and outline areas.
2. Secure Landscape Architect's approval before planting.
3. Make minor adjustments as may be necessary or requested.

3.03 INSTALLATION

A. Planting Pit Excavation
1. If underground construction work or obstructions are encountered in excavation of planting pits, Landscape Architect will select alternate locations.
2. Excavation Size -
a. Install plants delivered in 1 gallon cans in planting pits at least 14 inches in diameter.
b. Install plants delivered in 3 gallon cans in planting pits at least 24 inches in diameter.
c. Install plants delivered in 7 and 10 gallon cans in planting pits at least 30” in diameter.
d. Plant trees and palms in holes at least two times greater in diameter than their root ball.

d. Depth -
   (1) Holes for shrubs shall be deep enough to allow 6 inches minimum of planting mix beneath root ball.
   (2) Holes for trees and palms shall be 2 times the width of the root ball and 2 inches less then the height of the root ball.

3. Roughen sides and bottoms of excavations.
4. After each planting pit is excavated to proper depth, fill with planting mix and tamp sufficient to bring plant to desired elevation.

B. Planting
1. Plant immediately after removing plant from container. Remove shrubs, vines, and ground cover plants from containers without damaging roots.
2. After placing balled and burlapped ("B&B") trees and palms in planting pits, cut and remove burlapps down from the bottom of the rootball.
3. Place trees, palms, and shrubs centered in planting pits so that, after watering and settling, plant shall be approximately 2 inches above surrounding finished grade.
4. Properly cut off broken or frayed roots.
5. Center plant in hole and backfill with specified planting mix making saucer of mounded excavated soil around hole's perimeter to form watering basin.
6. During backfilling and planting operations, add Agriform planting tablets evenly spaced around and half-way betwwen the top and bottom of the root ball,as follows:
   a. One gallon shrub - 1 tablet
   b. Three gallon shrub - 3 tablets
   c. Seven gallon and 10 gallon shrubs - 4 tablets
   d. Trees and palms - 6 Tablets
7. Settle by firming and watering to bring root ball to proper level.
8. Do not use muddy soil for backfilling.
9. Make adjustments in positions of plants as directed by Landscape Architect.
10. Thoroughly water trees, palms, shrubs, vines, and ground cover immediately after planting.
11. At base of each tree planted in open areas , leave 24 inch diameter circle free of any grass, and mulch to loose measure depth of 3".

C. Guying for Trees and Palms
1. In planting, include placement of adequate support for trees and palms 2 ½" or greater in caliper.
2. Support shall be installed per the plans.

D. Ground Cover
1. Container-grown unless otherwise specified on Construction Drawings. Space evenly to produce a uniform effect.

2. Stagger in rows and intervals, creating an equlateral triangle among any three plants in two adjacent rows or columns.

E. Post Planting Weed Control
   1. Apply specified pre-emergent herbicide to shrub and ground cover planting areas after completion of planting. DO NOT SPRAY PLANT FOLIAGE.
   2. Planting areas shall be free of existing weed growth prior to application of herbicide.
   3. Apply herbicide in accordance with Manufacturer's recommendations.

F. Mulching
   1. After application of herbicide, mulch shrub and ground cover planting areas with loose measure 3 inch deep layer of approved mulch.
   2. Place mulch to uniform depth and rake to neat finished appearance.

END OF SECTION

SECTION 329450 – SILVA CELLS

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. Furnishing and installing Silva Cell system, including: geotextile, geogrids, aggregates, sub base material, backfill, drainage system, root barrier, compost, and the installation of planting soil.

1.3 DEFINITIONS

A. Aggregate Sub Base (below Cell frame): Aggregate material between the bottom of the Silva Cell frame and the compacted subgrade below, designed to distribute loads from the frame to the subgrade.

B. Aggregate Base Course (above Cell deck): Aggregate material between the paving and the top of the Silva Cell deck below designed to distribute loads across the top of the deck.

C. Aggregate Setting Bed – For Pavers (above Cell deck): Aggregate material between the aggregate base course and unit surface pavers, designed to act as a setting bed for the pavers.

D. Backfill: The earth used to replace or the act of replacing earth in an excavation beside the Silva Cell frames to the excavation extents.

E. Bridging Slab: Bridging slabs are to be used in locations where spacing larger than 3 inches (75 mm) is necessary between Silva Cell frames.

F. Compost: Organic material subjected to composting processes

G. Finish Grade: Elevation of finished surface of planting soil or paving.

H. Geogrid: Net-shaped synthetic polymer-coated fibers that provide a stabilizing force
within soil structure as the fill interlocks with the grid.

I. Geotextile: A geosynthetic fabric, applied to either the soil surface or between materials, providing filtration, separation, or stabilization properties.

J. Irrigation: Trees planted in the Silva Cell system must receive adequate water to ensure survival of the living system during periods of drier weather. Harvest of natural rainwater or supplemental water must be a part of the system, either through pressurized or non-pressurized systems, within the soil of the Silva Cell system.

K. Planting Soil: Soil as defined in Division 2 Section 32 94 56, Planting Soil for Silva Cells, intended to fill the frames and other planting spaces.

L. Root Barrier: Plastic root diversion device.

M. Root package: The earthen package containing the root system of the tree as shipped
from the nursery.

N. Silva Cells: Plastic structural cellular system with posts, beams and decks designed to be filled with planting soil for tree rooting and support of vehicle loaded pavements. The soil within the cells may also be used as part of rainwater filtering, retention and detention systems.

O. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.

P. Strongback: Modified Silva Cell frame designed to be attached to top of Silva Cells for stability while installing planting soil and backfill.

Q. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

R. Tree: A perennial woody plant with one or several trunks and a distinct crown and intended to become large enough to shade people and or vehicles.

S. Zip Tie: A tensioning device or tool used tie similar or different materials together with a specific degree of tension.

1.4 SUBMITTALS

A. Upon forty-five (45) days prior to start of installation of items in this section, the Contractor shall provide submittals required in this section to the landscape architect for review and approval.

B. Product Data: For each type of product, submit manufacturer's product literature with technical data sufficient to demonstrate that the product meets these specifications.

1. For bulk materials, including soils and aggregates, Include analysis of the materials by a recognized laboratory made that demonstrates that the material meets the specification requirements.

2. Silva Cell manufacturer's letter of review and approval of the project, plans, details and specifications for compliance with product installation requirements.

C. Silva Cell System Mock Up:

1. Prior to the installation of Silva Cells, construct a mock up of the complete installation at the site. The installation of the mock up shall be in the presence of the landscape architect.

2. The mock up shall be a minimum of 100 square feet in area and include the complete Silva Cell system installation with sub base compaction, drainage installation, base course aggregate and geotextile as required, geogrids, backfill, planting soil with compaction, decks, top geotextile and all necessary accessories.

3. The mock up area may remain as part of the installed work at the end of the project provided that it remains in good condition and meets all the conditions of the specifications.

D. Compaction testing results: Submit results of all compaction testing required by the specifications including the bulk density test of the mock up and installed soil to the landscape architect for approval.

E. Qualification Data: Submit documentation of the qualifications of the Silva Cell installer sufficient to demonstrate that the installer meets the requirements of paragraph "Quality Assurance".

1.5 SEQUENCING AND SCHEDULING

A. General: Prior to the start of Work, prepare a detailed schedule of the work for coordination with other trades.

B. Schedule all utility installations prior to beginning work in this section.

C. Where possible, schedule the installation of Silva Cells after the area is no longer required for use by other trades and work. Protect installed Silva Cells from damage in the event that work must occur over or adjacent to the completed Silva Cells.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Silva Cells and related products shall be installed by a qualified installer whose work has resulted in successful installation of planting soils and planter drainage systems, underground piping, chambers and vault structures.

1. Submit list of completed projects of similar scope and scale to the Owner, demonstrating capabilities and experience.

2. The installer and the field supervisor shall have a minimum of five years successful experience with construction of similar scope in dense urban areas.

3. Installer's Field Supervision: Installer is required to maintain an experienced fulltime supervisor on Project site when work is in progress. This person shall be identified during the Pre-installation Conference, with appropriate contact information provided, as necessary. The same supervisor shall be utilized throughout the Project, unless a substitution is submitted to and approved in writing by the Owner.

1.7 LAYOUT AND ELEVATION CONTROL

A. Provide layout and elevation control during installation of Silva Cells. Utilize grade stakes, benchmarks, surveying equipment and other means and methods to assure that layout and elevations conform to the layout and elevations indicated on the plans.

1.8 PERMITS AND CODE COMPLIANCE

A. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary permits/approvals from all such authorities.

1.9 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. Protect materials from deterioration during delivery and while on the project site.

B. Bulk Materials:

1. Do not deliver or place backfill, soils and soil amendments in frozen, wet, or muddy conditions.

2. Provide protection including tarps, plastic and or matting between all bulk materials and any finished surfaces sufficient to protect the finish material.

C. Provide erosion-control measures to prevent erosion or displacement of bulk materials and discharge of soil-bearing water runoff or airborne dust to adjacent properties, water conveyance systems, and walkways. Provide additional sediment control to retain excavated material, backfill, soil amendments and planting mix within the project limits as needed.

D. Silva Cells: Protect Silva Cells from damage during delivery, storage and handling.

1. Store under tarp to protect from sunlight when time from delivery to installation exceeds one week. Storage should occur on smooth surfaces, free from dirt, mud and debris

2. Handling is to be performed with equipment appropriate to the size (height) of Cells and site conditions, and may include, hand, handcart, forklifts, extension lifts, or small cranes, with care given to minimize damage to Silva Cell frames, decks and adjacent Silva Cells.

1.10 PROJECT CONDITIONS

A. Verification of Existing Conditions and Protection of New or Existing Improvements: Before proceeding with work in this section, the Installer shall carefully check and verify all dimensions, quantities, and grade elevations, and inform the landscape architect immediately of any discrepancies.

1. Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging. Verify the location of all aboveground and underground utility lines, infrastructure, other improvements, and existing trees, shrubs, and plants to remain including their root system, and take proper precautions as necessary to avoid damage to such improvements and plants.

2. In the event of conflict between existing and new improvements notify the landscape architect in writing and obtain written confirmation of any changes to the work prior to proceeding.

3. When new or previously existing utility lines are encountered during the course of excavation, notify the landscape architect in writing and make recommendations as to remedial action. Proceed with work in that area only upon approval of appropriate remedial action. Coordinate all work with the appropriate utility contractors, utility company or responsible public works agency.

B. Weather Limitations: Do not proceed with work when subgrades, soils and planting soils are in a wet, muddy or frozen condition.

C. Protect partially completed Silva Cell installation against damage from other construction traffic with highly visible construction tape, fencing, or other means until construction is complete. Prevent all non-installation related construction traffic over the completed Silva Cell installation; allowing only loads less than the design loads.

1.11 PROTECTION

A. Protect open excavations and partially completed Silva Cell installation from access and damage when work is in progress, and following completion with highly visible construction tape, fencing, or other means until all construction is complete.

1.12 WARRANTY

A. Silva Cell manufacturer's product warranty shall apply. Submit manufacturer's product warranty.

1.13 PROJECT WORK

A. Coordinate installation with all other work that may impact the completion of the work.

1.14 PRECONSTRUCTION MEETING

A. Prior to the start of the installation of Silva Cells, meet at the site with the landscape architect, general contractor and the Silva Cells installer to review installation layout, procedures, means and methods.

PART 2 – PRODUCTS

2.1 SILVA CELLS

A. Fiberglass-reinforced polypropylene structures including frames and decks designed to support sidewalk loads and designed to be filled with soil for the purpose of growing tree roots, and rainwater filtering, detention and retention.

B. Silva Cell Frames: 400 mm x 600 mm x 1200 mm (16 inches x 24 inches x 48 inches).

C. Silva Cell Deck: 5 cm x 600 mm x 1200 mm (2 inches x 24 inches x 48 inches). Deck to include manufactured installed galvanized steel tubes.

D. Silva Cell Strongback: 400 mm x 600 mm x 150 mm (24 inches x 48 inches x 6 inches) modified Silva Cell Frame units designed to stiffen and align the frames as planting soil and backfill material is placed. Strongbacks are to be removed prior to placing decks. They are to be reused as the work progresses.

E. Silva Cell Deck Screws: Manufacturer's supplied stainless steel screws to attach decks to frames.

F. Manufacturer: DeepRoot Partners, L.P. (Deep Root); 530 Washington Street, San Francisco, CA 94111; 415.781.9700; 800.458.7668; fax 415.781.0191; www.deeproot.com..

2.2 ANCHORING SPIKES

A. 10" (250 mm) long X 19/64" (8 mm) diameter, spiral, galvanized timber spikes. Utilize 4 spikes in each frame on the first layer of Silva Cells to anchor the frames to the aggregate sub base.

2.3 GEOGRID

A. Geogrid shall be woven polyester fabric with PVC coating, Uni-axial or biaxial geogrid, inert to biological degradation, resistant to naturally occurring chemicals, alkalis, acids.
   a. Tensile strength at ultimate: 1850 lbs/ft (27.0 kN/m) minimum by ASTM D6637 test method
   b. Creep reduced strength : 1000 lbs/ft (14.6 kN/m) minimum by ASTM D5262 test method
   c. Long term allowable design load: 950 lbs/ft (13.9 kN/m) minimum by GRI GG-4 test method
   d. Grid aperture size (MD): 0.8 inch (20 mm) minimum
   e. Grid aperture size (CD): 1.28 inch (32 mm) maximum
   f. Roll size: 6' (1.8m) width is preferred, up to 18' (5.4m)

B. Products meeting this specification:
   a. Miragrid 2XT as manufactured by Ten Cate Nicolon, Norcross, GA, http://www.tencate.com (Distributed by Geosynthetic Systems in Ontario)
   b. Fortrac 35 Geogrid as manufactured by Huesker, Charlotte, NC, http://www.hueskerinc.com/
   c. SF 20 Biaxial Geogrid, as manufactured by Synteen, Lancaster, SC, http://www.synteen.com
   d. Stratagrid SG 150, by Strata, Cumming, GA, http://www.geogrid.com

2.4 GEOTEXTILE

A. Geotextile shall be nonwoven polypropylene fibers, inert to biological degradation and resistant of naturally occurring chemicals, alkalis and acids.
   1. Grab tensile strength: 200 lbs (900 N) minimum *(ASTM D 4632 test method)*
   2. Elongation: 50% maximum *(ASTM D 4632 test method)*
   3. Trapezoid tear strength: 80 lbs (350 N) minimum (ASTM D 4533 test method)
   4. Mullen burst strength: 350 psi (2400 kPa) minimum (ASTM D 3786 test method)
   5. Puncture strength: 110 lbs (490 N) minimum (ASTM D 4833 test method)

6. CBR puncture strength: 500 lbs (2225 N) minimum (ASTM D 6241 test method)
7. Apparent opening size: 80 sieve (0.18mm) maximum (ASTM D 4751 test method)
8. Flow rate: 95 gal/min/ft2 (3870 l/min/m2) minimum (ASTM D 4491 test method)
9. UV Resistance (at 500 hours): 70% strength retained

B. Products meeting this specification:

1. Mirafi 180 N as manufactured by Ten Cate Nicolon, Norcross, GA, http://www.tencate.com

   a. In Canada, distributed by Geosynthetic Systems and Armtec (as Armtec 250)

2. Geotex 801 as manufactured by Propex Geosynthetics, Chattanooga, TN, http://www.geotextile.com

   a. In Canada, distributed by Nilex (as Nilex 4553)

2.5 AGGREGATE SUB BASE (BELOW CELL FRAME)

A. Aggregate meeting one of the following specifications:

1. ASTM D1241-07, Type 1, Gradation B Standard Specification for Materials for Soil-Aggregate Sub base, Base, and Surface Courses.
   a. Type I mixtures shall consist of stone, gravel, or slag with natural or crushed sand and fine mineral particles passing a No. 200 sieve.

Sieve	Percent Passing
1.5" (37.5 mm)	100
1” (25 mm)	75-95
3/8” (9.5 mm)	40-75
No 4 (4.75 mm)	30-60

No 10 (2.0 mm)	20-45
No 40 (425 µm)	15-30
No 200 (75 µm)	5-15

2. Local Department of Transportation virgin aggregate that most closely meets the gradation of ASTM D1241-07.

3. Ontario Provincial Standard Specification (OPSS) 1010 Granular A. Dense graded aggregates intended for use as granular base within the pavement structure, granular shouldering, and backfill.

Sieve	Percent Passing
26.5 mm	100
19.0 mm	85-100
13.2 mm	65-90
9.5 mm	50-73
4.75 mm	35-55
1.18 mm	15-40
300 µm	5-22
75 µm	2-8

2.6 AGGREGATE BASE COURSE (ABOVE CELL DECK)

A. SEE AGGREGATE SUB BASE

2.7 AGGREGATE BASE COURSE FOR POROUS PAVEMENT (ABOVE CELL DECK)

A. Aggregate meeting one of the following specifications:

1. American Society for Testing and Materials (ASTM) D 448, No. 57

Sieve	Percent Passing
1.5” (37.5 mm)	100
1” (25mm)	95-100
1/2” (12.5 mm)	25-60
No 4 (4.75 mm)	0-10
No 8 (2.36 mm)	0-5

2.8 SETTING BED FOR UNIT PAVERS (ABOVE CELL DECK)

A. Aggregate meeting one of the following specifications:

1. American Society for Testing and Materials (ASTM) D 448, No. 8

Sieve	Percent Passing
1/2” (12.5 mm)	100
3/8” (9.5mm)	85-100
No 4 (4.75 mm)	10-30
No 8 (2.36 mm)	0-10
No 16 (1.18 mm)	0-5

2.9 BACKFILL MATERIAL (ADJACENT TO SILVA CELLS):

A. Clean, compactable, coarse grained fill soil meeting the requirements of the Unified Soil Classification system for soil type GW, GP, GC with less than 30% fines, SW, and SC with less than 30% fines. Backfill material shall be free of organic material, trash and other debris, and shall be free of toxic material injurious to plant growth.

B. Submit supplier certificate for material meeting this specification.

2.10 PLANTING SOIL: (See Specification Section 32 94 56 - Planting Soil for Silva Cells)

2.11 ROOT BARRIER

A. Root Barrier shall be DeepRoot; Tree Root Barriers; UB 18-2, manufactured by DeepRoot Partners, L.P. (Deep Root); 530 Washington Street, San Francisco, CA 94111; 415.781.9700; 800.458.7668; fax 415.781.0191; www.deeproot.com.

B. Material: Black, injection molded panels, 0.080"(2.03mm) wall thickness in modules 24” (61cm) long by 18” (46cm) deep; manufactured with a minimum 50% postconsumer recycled polypropylene plastic with UV inhibitors; recyclable. Integrated zipper joining system providing for instant assembly by sliding one panel into another.

PART 3- EXECUTION

3.1 LAYOUT APPROVAL

A. Prior to the start of work, layout and stake the limits of excavation and horizontal and
vertical control points sufficient to install the Silva Cells and required drainage features in the correct locations.

3.2 EXCAVATION

A. Excavate to the depths and shapes indicated on the drawings. Base of excavation shall be smooth soil, level and free of lumps or debris.

B. Do not over-excavate existing soil beside or under the limits of excavation required for the installation. If soil is over-excavated, install compactable fill material in lifts not more than 8 inches (200 mm) deep and compact to the required density.

C. Confirm that the depth of the excavation is accurate to accommodate the depths and thickness of materials required throughout the extent of the excavation.

D. Confirm that the width and length of the excavation is a minimum of 6 inches (150 mm), in all directions, beyond the edges of the Silva Cells.

3.3 SUBGRADE COMPACTION

A. Check compaction of the subgrade below the Silva Cells and confirm that the subgrade soil is compacted to a minimum of 95% of maximum dry density at optimum moisture content in accordance with ASTM D 698 Standard Proctor Method.

B. Proof compact the subgrade with a minimum of three passes of a suitable vibrating compacting machine or apply other compaction forces as needed to achieve the required subgrade compaction rate.

C. Apply additional compaction forces at optimum water levels.

3.4 INSTALLATION OF GEOTEXTILE OVER SUBGRADE

A. Where indicated on drawings, install geotextile over compacted subgrade.

B. Removal of the geotextile as a standard component of the Silva Cell system must be determined by professional civil or geotechnical engineer.

C. Install the geotextile with a minimum joint overlap of 18 inches (450 mm) between sections of material. Ensure geotextile is laid flat with no folds or creases.

3.5 INSTALLATION Of AGGREGATE SUB BASE BELOW SILVA CELL FRAME

A. Install aggregate sub base to the depths indicated on the drawings, under the first layer of Silva Cell frames. Sub base aggregate shall extend a minimum of 6 inches (150mm) beyond the edge of the Cell frames.

B. Compact aggregate sub base layer to a minimum of 95% of maximum dry density at optimum moisture content in accordance with ASTM D 698 Standard Proctor Method. Compact the subgrade with a minimum of three passes of a suitable vibrating compacting machine or apply other compaction forces as needed to achieve the required subgrade compaction rate.

C. The maximum slope on the surface of the sub base shall be 5%. Where proposed grades on finished paving are greater than 5%, the Cells shall be stepped to maintain proper relationships to the finished grade.

D. The grade and elevations of the base under the Silva Cells shall be approved by the landscape architect prior to proceeding with the installation of the Silva Cells.

3.6 INSTALLATION OF SILVA CELLS, PLANTING SOIL, GEOGRID, AND BACKFILL

A. Identify the outline layout of the structure and the edges of paving around tree planting areas on the floor of the excavation, using spray paint or chalk line.

B. Lay out the first layer of Silva Cell frames on the sub base. Verify that the layout is consistent with the required locations and dimensions of paving edges to be constructed over the Silva Cells.

C. Check each Silva Cell frame unit for damage prior to placing in the excavation. Any cracked or chipped unit shall be rejected.

D. Place frames no less than 1 inch (25 mm) and no more than 3 inches (75 mm) apart at base. In the event that spacing between Cells exceeds 3 inches (75 mm), bridging slab details and methods shall be used to span these gaps.

E. Install Silva Cell frames around, over, or under existing or proposed utility lines as indicated on plans.

F. Where any two adjacent Silva Cell frames must be installed at different elevations, the upper frame shall be supported by aggregate sub base with a

maximum slope of 1:1. This may require installation of aggregate sub base within the adjacent lower Cell frame. No two frames shall differ in elevation by more than 15 inches (375 mm).

G. Assure that each frame sits solidly on the surface of the sub base. Frames shall not rock or bend over any stone or other obstruction protruding above the surface of the sub base material. Frames shall not bend into dips in the sub base material. The maximum tolerance for deviations in the plane of the sub base material under the bottom of the horizontal beams of each Silva Cell frame shall be 1/4 inch (6 mm) in 4 feet (1200 mm).

H. Adjust sub base material including larger pieces of aggregate under each frame to provide a solid base of support.

1. Anchor each Silva Cell into sub base with four-10 inch (250 mm) spikes, driven through the molded holes in the Cell frame base. The purpose of the anchoring system is to maintain cell spacing and layout during the installation of planting soil and backfill.

2. For applications where cells are installed over waterproofed structures, develop a spacing system consistent with requirements of the waterproofing system. Do not use anchoring nails that will come within 6" or less of any waterproofing material.

I. Install the second layer of Silva Cell frames on top of the first layer. Comply with manufacturer's requirements to correctly register and connect the Cell frames together.

J. Register each frame on top of the lower frame post. Rotate each frame registration arrow in the opposite direction from the frame below to assure that connector tabs firmly connect. Each frame shall be solidly seated on the one below.

K. Build layers as stacks of frames set one directly over the other. Do not set any frame half on one Cell frame below and half on an adjacent frame.

L. Install Strongbacks on top of the Silva Cell frames prior to installing planting soil and backfill.

1. Strongbacks are required only during the installation and compaction of the planting soil and backfill.

2. Strongbacks should be moved as the work progresses across the installation.

3. Strongbacks shall be removed prior to the installation of Silva Cell decks.

M. Install planting soil, geogrid and backfill as indicated on the drawings. The process of installation requires that these three materials be installed and compacted together in several alternating operations to achieve correct compaction relationships within the system.

N. Where required, place the geogrid curtain along the outside of the limit of the Silva Cell frames.

1. Geogrid curtains are required between the edge of the Silva Cells and any soils to be compacted to support paving beyond the area of Silva Cells. Do not place geogrid curtains between the edge of the Cells and any planting area adjacent to the Cells.

2. Pre-cut the geogrid to allow for 6 inches (150 mm) minimum under lapping below backfill, and 12 inches (300 mm) minimum overlapping top of Silva Cell stack.

3. Where Silva Cell layout causes a change direction in the plane of the geogrid, slice the top and bottom flaps of the material so that it lies flat on the top of the cell deck and aggregate base course along both planes.

4. Provide a minimum of 300 mm (12 inch) overlaps between different sheets of geogrid.

5. Place the geogrid in the space between the Silva Cell frames and the sides of the excavation. Attach the geogrid to the Silva Cell frames using 3/16 inch x 14-inch (5x350 mm) zip ties. Attach with zip ties at every cell and at Cell Deck.

O. Install no more than two layers of Silva Cell frames before beginning to install planting soil and backfill. Compact the planting soil within the Silva Cell frames and the backfill material outside the frames in alternating lifts until the desired elevations and density is achieved in both planting soil and backfill.

P. Install and compact backfill material in the space between the Silva Cells and the sides of the excavation in lifts that do not exceed 8 inches (200 mm).

1. Compact backfill to 95% of maximum dry density using a powered mechanical compactor. Use a pneumatic compacting tool or narrow foot jumping jack compactor for spaces less than 12 inches (300 mm) wide and a 12-inch wide jumping jack compactor or larger equipment in wider spaces.

2. Maintain the geogrid curtain between the Silva Cells frames and the backfill material.

3. Install backfill in alternating lifts with the planting soil inside the Silva Cells.

Q. Fill the first layer or layers of frames with planting soil, specified in Section 32 94 56 Planting Soil for Silva Cells.

1. Bring planting soil to the site using equipment and methods that do not overly mix and further damage soil peds within the soil mix. Soil mixes shall not be blown or pumped into the Cells using soil blowing equipment.

2. Install in lifts that do not exceed 16 inches (400 mm). Lightly compact the soil inside the frames at each lift to remove air pockets and settle the soil within the frames.

3. Do not compact greater than 80% of maximum dry density. Check the soil compaction with a penetrometer or densiometer to achieve similar compaction levels provided in the mock up.

4. If the planting soil becomes overly compacted, remove the soil and reinstall. Use hand tools or other equipment that does not damage the Silva Cell frames.

5. Do not walk directly on horizontal beams of the frames.

6. Work soil under the horizontal frame beams of the second level of Cell frames and between columns eliminating air pockets and voids. Fill each frame such that there is a minimum of 10 inches (250 mm) of soil over the top of horizontal frame beams before beginning compaction.

7. The top 1-2 inches (25-50 mm) of each frame post should remain exposed above the soil to allow the placement of the next frame or deck.

R. After the first two layers of Silva Cell frames have been installed, filled with planting soil and backfilled, proceed to install the third layer, if required, of Silva Cells frames. Comply with manufacturer's requirements to correctly register and connect the Cell frames together.

S. Remove the strongbacks. Sweep any soil from tops before adding the next layer of frames.

T. Register each frame on top of the lower frame post. Rotate each frame registration arrow in the opposite direction from the frame below to assure that connector tabs firmly connect. Each frame shall be solidly seated on the one below.

U. Build layers as stacks of frames set one directly over the other. Do not set any frame half on one Cell frame below and half on an adjacent frame.

V. Install Strongbacks on top of third layer of Silva Cells.

W. Continue to install and compact the planting soil within the Silva Cell frames and the backfill material outside the frames in alternating lifts until the desired elevations and density is achieved in both soils.

X. When using compost, add a final layer of planting soil as required to bring the planting soil level to not more than 3 inches (75 mm) below the bottom of the Silva Cell Deck when installed. When using air space rather than compost, the planting soil shall be brought to level not more than 1 inch (25 mm) below the bottom of the Silva Cell Deck when installed.

Y. Obtain final approval by the landscape architect of soil installation prior to installation of the Silva Cell deck.

Z. Remove Strongbacks after planting soil and backfill has been compacted to the top of the entire set of Silva Cells.

AA. Install 3 inches (75 mm) of compost, or leave 1-inch (25 mm) air space, below Silva Cell Deck as indicated on the drawings.

3.7 IRRIGATION AND WATER HARVESTING SYSTEM INSTALLATION

A. Install irrigation and water harvesting system per project specifications.

3.8 SILVA CELL DECK INSTALLATION

A. Install the Silva Cell Decks over the top of each frame stack. Clean dirt from the tops of the Silva Cell frame columns. Register the deck and make connections as recommended by the manufacturer to secure the deck to the top of the Silva Cell Frame. Secure each deck at the four corners with screw fasteners as recommended by the manufacturer. Assure that each deck is seated firmly on the frame top with all connectors attached.

B. Install and compact remaining backfill material such that the soil outside the limits of the Silva Cells is flush with the top of the installed deck.

3.9 INSTALLATION OF GEOTEXTILE, GEOGRID, INSPECTION RISER FOR SOIL, AND AGGREGATE OVER THE DECK

A. Overlap geogrid from the sides of the Silva Cells over the top of the Silva Cell Decks, with minimum of 12 inches (300mm) overlap.

B. Place geotextile over the top of the deck and where indicated on the drawings, extending beyond the outside edge of the excavation by at least 18 inches (450 mm). Any joints must be overlapped by a minimum of 18 inches (450 mm).

C. Install inspection risers for soil above geotextile as indicated on drawings.
   1. Cut PVC pipe to fit vertically from Silva Cell deck to finish surface.

2. Align riser with slots in Silva Cell deck.
3. Wrap pipe in geotextile and secure with zip ties. Cut geotextile to overlap deck minimum 12”.
4. Cut geotextile inside the pipe to allow access. Do not cut or otherwise damage Silva Cell deck.
5. Install caps on top of each riser flush with final paving surface.

D. Install the aggregate base course (including aggregate setting bed if installing unit pavers) over the geotextile immediately after completing the installation of the fabrics and inspection risers. Work the aggregate from one side of the deck to the other to assure that the fabric and aggregate conforms to the cell deck contours. Do not apply aggregate in several positions at the same time.

1. Aggregate base course shall be a minimum of 4 inches (100mm) thick under pored in place concrete paving.

2. Aggregate base course shall be a minimum of 12 inches (300mm) thick under unit pavers, asphalt paving, or porous paving.

E. Load the aggregate from equipment that is outside the limits of the excavated area. Work over material already in place.

F. For large or confined areas, where aggregate cannot easily be placed from the edges of the excavated area, obtain approval for the installation procedure and types of equipment to be used in the installation from the Silva Cell manufacturer.

G. Compact aggregate base course(s) in lifts not to exceed 6" in depth, to 95% of maximum dry density. Utilize a roller or plate compactor with a maximum weight of 1000 pounds. Make sufficient passes with the compacting equipment to attain the required compaction.

3.10 INSTALLATION OF PAVING ABOVE THE SILVA CELL SYSTEM

A. Place paving material over Silva Cell system per project specifications. Take care when placing paving or other backfill on top of Silva Cell system not to damage the system components.

B. Turn down edge of all concrete paving to Cell deck along the edges of all planting areas to retain the aggregate base course.

C. When paving is a unit paver or other flexible material, provide a concrete curb under the paving at the edge of the Silva Cell deck to retain the aggregate base course material.

3.11 INSTALLATION OF BRIDGING SLABS (WHERE APPLICABLE)

A. Bridging slabs are to be used in locations where spacing larger than 3 inches (75 mm) is necessary between Silva Cell frames.

B. Replace aggregate base course material with a minimum 4 inch (100 mm) concrete slab beneath paving. The paving shall extend beyond the gap between Cells at a minimum of 24 inches (610 mm).

C. If spacing (gap) between Cells is larger than 12 inches (300 mm), the concrete slab must be increased to 6 inch (150 mm) thickness. If spacing (gap) between Cells is larger than 18 inches (450 mm), steel reinforcing shall be added to the slab. Reinforcing is to be designed by the project structural engineer. In no case shall the space between Cells be greater than 30 inches (750 mm).

3.12 INSTALLATION OF ROOT BARRIERS

A. Install root barrier in accord with manufacturer's reviewed installation instructions.

3.13 INSTALLATION OF PLANTING SOIL WITHIN THE TREE PLANTING AREA

A. Prior to planting trees, install additional planting soil, to the depths indicated, within the tree opening adjacent to paving supported by Silva Cells.

B. Remove all rubble, debris, dust and silt from the top of the planting soil that may have accumulated after the initial installation of the planting soil within the Silva Cells.

C. Assure that the planting soil under the tree root ball is compacted for the entire soil depth to 85-90% to prevent settlement of the root ball.

D. The planting soil within the tree opening shall be the same soil as in the adjacent Silva Cells.

E. Cover the planting soil finished grade with 2 inches (50 mm) of mulch, or as defined in Project specifications.

3.14 REPAIR OF CUT GEOTEXTILE

A. In the event that any geotextile over subgrades or the Silva Cell decks must be cut during or after installation, repair the seam with a second piece of geotextile that overlaps the edges of the cut by a minimum of 12-inches in all directions prior to adding aggregate material.

3.15 PROTECTION

A. Ensure that all construction traffic is kept away from the limits of the Silva Cells until the final surface materials are in place. No vehicles shall drive directly on the Silva Cell deck or aggregate base course.

B. Provide fencing and other barriers to keep vehicles from entering into the area with Silva Cell supported pavement.

C. Maintain a minimum of 4 inches (100 mm) of aggregate base course over the geotextile material during construction.

D. When vehicle must cross Silva Cells that does not have final paving surfaces installed, use construction mats designed to distribute vehicle loads to levels that would be expected at the deck surface once final paving has been installed. Use only low impact track vehicles with a maximum surface pressure under the vehicle of 4 pounds per square inch, on top of the mats over Silva Cells prior to the installation of final paving.

3.16 CLEAN UP

A. Perform cleanup during the installation of work and upon completion of the work. Maintain the site free of soil and sediment, free of trash and debris. Remove from site all excess soil materials, debris, and equipment. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

SECTION 331000 - WATER UTILITIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, Division 1 - General Requirements shall govern the work under this Section

1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the Water Systems work, as indicated on the drawings, as specified herein or both.

1.3 EXISTING UTILITIES

A. Furnish temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work.

B. Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipe branch connections to main sewers, or main drains, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the CONTRACTOR in cooperation with the owners of such utility structures. No deviation shall be made from the required line or grade except as directed by the ENGINEER.

1.4 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

PART 2 – PRODUCTS

2.1 PIPE

A. All pipes shall have a minimum working pressure of 150 psi.

B. Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51. Pipe shall be cement-lined and seal-coated.

1. Unless otherwise indicated, all ductile iron pipe shall be factory lined and coated.
   a. Lining: All pipe shall be cement mortar lined in accordance with AWWA Standard C104.
   b. Coating: Unless specified otherwise, all pipe shall be coal-tar enamel coated outside to a dry film thickness of at least 1 mil.
   c. Repair: Anywhere that the coating is removed purposely or accidentally, the area shall be cleaned of any rust, grease and dirt and recoated to a minimum dry film as specified for the individual piece.

C. l water main pipe, including fittings, shall be color coded or marked using blue as a predominant color to differentiate drinking water from reclaimed or other water. Underground plastic pipe shall be solid wall blue pipe.

2.2 FITTINGS

A. The pressure rating shall be 150 psi for fittings.

B. Fittings shall be cast iron or ductile iron.

C. Fitting must be cement lined and seal coated.

D. Ductile iron fittings shall conform to ANSI/AWWA C110-A21.10.

2.3 JOINTS

A. BELL AND SPIGOT CONNECTIONS:
1. Joints in bell and spigot pipe shall be push-on, mechanical, or restrained mechanical joints in accordance with ANSI/ANWA C-111/A21.11, latest revision.

B. FLANGED CONNECTIONS:
1. Flanges shall be in accordance with ANSI Specification B16.1 for Class 125 flanges. Bolts shall comply with ANSI B18.2.
2. Flanged pipe shall be faced and drilled to the American Standard drilling, unless special drilling is called for or required. Where tap or stud bolts are required, flanges shall be tapped. Flanges shall be accurately faced and drilled smooth and true, at right angles to the pipe axis and shall be covered with zinc dust and tallow or a rust preventive compound immediately after facing and drilling.
3. Flanged joints shall be made with bolts or stud bolts and nuts. Bolts, stud bolts, and nuts shall conform to American Standard heavy dimensions, semi-finished with square or hexagonal heads and cold punched hexagonal nuts, meeting the requirements of ASTM Designation A-307.

2.4 HYDRANTS

A. Fire hydrants shall have a 5 1/4" main valve opening. Pumper nozzle to be eighteen (18) inches from finish grade. All hydrants to be installed with anchoring tee and control valve. Fire hydrant shall comply with ANSI/AWWA C502-85 (or latest revision). Hydrants shall be painted in accordance with requirements of the City.

B. Fire hydrants installed that have not been placed into service shall have a “Not in Service” tag to indicate that they are out of service.

2.5 WATER TAPS (If required)

A. Tapping Existing Pipelines.

1. Cast iron tapping sleeve or tapping cross shall have mechanical joint connections. The flanged end for tapping valve shall include a recess to provide positive alignment of the tapping valve.
2. Tapping valves shall conform to AWWA C509 and C500 standards. An Affidavit of Compliance shall be furnished for the valves.
3. Tapping valves sixteen (16) inch and smaller shall be designed for operation in a vertical position with a vertical operating shaft. Tapping valves over sixteen (16) inch shall be designed for operation in a horizontal position and shall have a vertical operating shaft.

2.6 WATER SERVICES

A. Water services shall be copper tubing K type or polyethylene tubing.

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL

A. Unloading Material: The CONTRACTOR shall exercise care in unloading and handling pipe, valves, fittings, and all other material. Dropping pipe from trucks and allowing pipe to roll against other pipe will not be permitted.

B. Excavation: Pipe line trenches shall be excavated to required depth as shown on the drawings or as directed by the ENGINEER. In general, water distribution lines shall have a minimum of 30" cover for DIP pipe except where installed within any 70'-200' right-of-way which shall have a minimum of 36" cover. If rock is encountered, excavation shall be carried a minimum of 8" below bottom of pipe, and trench backfilled with sand or earth and thoroughly tamped. Width of trench shall be sufficient to allow workers to perform all operations incidental to constructing the pipe line. Hand dug bell holes shall be provided to permit proper joint making. No section of pipe shall bear on rock or on placed blocking.

C. Work shall be properly braced where necessary. Where wood sheeting or certain designs of steel sheeting are used, the sheeting shall be cut off at a level two feet above the top of the installed pipe and that portion below that level shall be left in place. If interlocking steel sheeting of a design approved by the ENGINEER is used, it may be removed providing removal can be accomplished without disturbing the bedding or alignment of the pipe. Any damage to the pipe bedding, pipe or alignment of the constructed main caused by removal of sheeting shall be cause for rejection of the affected portion of the work.

3.2 PIPE

A. Installation of Pipe: All installation shall conform to AWWA Standards. Pipe shall not be rolled or pushed into the trench from the bank. Before pipe is lowered into the trench, it shall be thoroughly inspected by the CONTRACTOR, as necessary, to insure sound conditions and eliminate the possibility of leakage or bursting under test pressure.

B. Water mains shall be laid at least ten (10) feet horizontally from any existing or proposed sewer mains. A vertical distance of at least eighteen (18) inches should be maintained when a sewer pipe crosses under a water main. If this is not possible, then the sewer pipe must

be of water main quality with twenty (20) foot lengths of pipe centering on the point of crossing. If a crossing where the sewer is laid above a water line is unavoidable, then the above mentioned precautions shall be observed regardless of the distance of vertical separation between water mains and sewer piping.

C. Pipes and valves, fittings, and all other materials showing defects shall not be used for construction. All such defective materials shall be removed from the construction site immediately. Before pipe is lowered into the trench, it shall be swabbed or brushed to insure that no dirt or foreign matter will be in the finished line.

D. Pipe shall be laid on a flat bottom trench and backfill tamped to 6" above the top to the pipe. Pipe installation shall conform to "Type B Method" as adopted by Committee A-21 of the American Standards Association. A firm even bearing shall be provided throughout the length of each section of pipe. Pipe shall not bear on any unyielding structures, nor shall it support any other structures. All dead ends shall be plugged or capped, anchored and held in place with restrained joints as required. Except while work is in progress, all pipe openings shall be suitably plugged to prevent entrance of water or any foreign matter. Material deemed unstable for providing adequate support for pipe shall be removed and replaced by suitable material. Adequate backfill shall be deposited on the pipe to prevent floating. Any pipe which has floated shall be removed from the trench and reinstalled as directed by the ENGINEER.

E. Joints: All joints shall be suitable for the type of pipe being jointed and shall be made in accordance with manufacturer's recommendations.

1. Mechanical joints: Mechanical joints shall be of the stuffing box type. The gland, followed by the rubber gasket, shall be placed over the plain end of the pipe which is inserted into the socket. The gasket is then pushed into position so that it is evenly seated in the socket. The gland shall be moved into position against the face of the socket, bolts inserted and made finger-tight. Bolts shall be tightened by a ratchet wrench suitable for the size of pipe being connected alternately, bottom, then top, etc., until the joint is completed.
2. Compression Pipe joints: Compression joints shall be a rubber seal joint, made pressure tight by a molded rubber gasket and lubricated to facilitate assembly. The joint shall be made tight by inserting the plan end into the bell after lubrication. Joints shall be made up as recommended by the manufacturer.
3. Flanged joints: Flanged joints shall be made with rubber gaskets. Bolts shall have rough square hands and hexagonal nuts and made to American Standard rough dimensions and shall be recommended size trimmed. Bolts shall be the recommended size for the diameter of the pipe being jointed and shall be tightened as to distribute evenly the stress in the bolts and bring the pipe into alignment.
4. Threads shall be neatly cut with sharp tools and the jointing procedure shall conform with the best practices. Before jointing, all scale shall be reamed. All pipe shall be screwed with an application of graphite and engine oil or other approved pipe compound applied to the threads. This application shall be thoroughly wiped off the inside of every joint.

3.3 INSTALLATION OF FITTINGS

A. Applicable portions of these specifications shall apply to installation of fittings. Reaction of restrained joints shall be applied at bends and tees and where changes in pipe diameter occur at reducers or in fittings.

3.4 INSTALLATION OF FIRE HYDRANTS

A. All hydrants shall stand plumb and burial line shall be set at finished grade. The pumper nozzle shall be set at eighteen (18) inches above finished grade. (Note: break-away flange to be three (3) to six (6) inches above finish grade.)

3.5 INSTALLATION OF VALVES

A. All valves shall stand plumb unless otherwise shown on the plans or directed by the ENGINEER. The operation of installing tapping sleeves and valves shall be done by an experienced entity having been engaged in this type of work not less than one (1) year with a representative list of successful installations.

3.6 PRESSURE TESTS

A. After pipe has been adequately backfilled all laid pipes shall be subjected to a hydrostatic pressure test. The duration of the pressure test shall not be less than two (2) hours. Test sections shall be limited to a maximum length of 2000 feet. Care shall be taken to insure that all air has been removed from the pipe previous to pressure tests. The CONTRACTOR shall provide such means of venting the pipe as are required. Any material or installation proving defective shall be replaced by the CONTRACTOR.

3.7 LEAKAGE TEST

A. After the main has been brought up to test pressure, it shall be held at this pressure and make up water shall be carefully measured by use of displacement meter or by pumping water from a vessel of known volume. The pipe line shall be walked and all visible joints inspected for leakage and movement of pipe. All visible leaks shall be repaired. Should any section of pipe line disclose joint leakage greater than that permitted, the CONTRACTOR shall at the CONTRACTOR's own expense, locate and repair the defective joints until leakage is within the permitted allowance.

B. The leakage test shall be conducted in accordance with AWWA C-600, latest revision. Leakage shall be less than the number of gallons per hour as determined by the formula:

$$L = \frac{SD\,P^{1/2}}{133{,}200}$$

in which L equals the allowable leakage in gallons per hour, S is the pipe length in the main tested, D is the nominal diameter of the pipe in inches, and P is the average test pressure during the leakage test, in pounds per square inch, gauge. Length of test shall not be less than two (2) hours. Average test pressure shall not be less than 150 psi. The test shall be conducted as directed by the ENGINEER.

3.8 BACKFILL

A. No trenches or excavations shall be backfilled until the trench and installation has been inspected and written approval given by the ENGINEER. All backfill shall be carefully placed to avoid movement of the pipeline. Backfill shall be free from rock, large stones, boulders, brush, or other unsuitable material. It shall be placed in the trench uniformly on both sides of the pipe for full width of the trench and to the horizontal diameter of the full length of the pipe. This backfill shall be thoroughly tamped to provide support free from voids.

B. Additional backfill shall then be placed between joints to an average depth of twelve (12) inches over the top of the pipe where pipe is of eight (8) inches and smaller diameter, and twenty-four (24) inches over larger pipe. Pipe joints shall remain exposed until completion of the pressure and leakage tests unless otherwise directed by the ENGINEER.

C. On completion of pressure and leakage tests, the exposed joints shall be backfilled to a depth of twelve (12) inches above the top of the pipe. Backfill shall be carefully compacted until twelve (12) inches of cover exists over the pipe. The remainder of the backfill shall then be placed and compacted thoroughly by puddling and tamping as required. Where directed, puddling and tamping may be omitted, and backfill shall be neatly rounded over the trench to a sufficient height to allow for settlement to grade after consolidation.

3.9 STERILIZATION OF COMPLETE PIPELINE

A. Before the final acceptance of complete pipeline, all requirements of the City of Delray Beach, County and the State of Florida health departments shall be satisfied. Satisfactory bacteriological test results from the agencies shall be forwarded to the ENGINEER.

B. Prior to chlorination of mains, all dirt and foreign matter shall be removed by high velocity flushing through fire hydrants or other approved blow-offs. The main shall then be filled with a chlorine solution of at least 50 parts per million of chlorine and retained in the pipe not less than twenty-four (24) hours. Chlorine residual after retention period shall be not less than 30 parts per million. After chlorination, the mains shall be thoroughly flushed with potable water and required samples taken for bacteriological analysis. Sampling is to be witnessed by the ENGINEER.

3.10 CONNECTION TO EXISTING SYSTEM

A. The CONTRACTOR shall make proper arrangements for compliance with the regulations for connection to any existing distribution system with the OWNER of that system. Tap in and connection will be made in strict accordance with the ENGINEER.

END OF SECTION - 331000

SECTION 333000 - SANITARY SEWER SYSTEM

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this Section.

1.2 WORK INCLUDED

A. The work under this Section shall consist of furnishing and installing sewer pipes and service connections as indicated on the plans and in accordance with these Specifications.

1.3 RELATED WORK

A. Section 312333 - Excavation and Backfilling for Utilities

B. Section 334100 - Storm Drainage Utilities

C. Section 334900 – Storm Drainage Structures

ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

PART 2 - PRODUCTS

2.1 PIPE

A. PVC plastic pipe and fittings for gravity sanitary sewers shall be unplasticized, PVC Plastic Gravity Sewer Pipe conforming to ASTM D 3034 with SDR 26 (minimum pipe stiffness of 115 lbs./in./in.) or ASTM D2680 (minimum pipe stiffness of 200 lbs./in./in.) with gasketed bell and spigot joints meeting the requirements of ASTM D3212. Sewer pipe, including laterals and fittings shall be manufactured from PVC Cell Classification 12454B or 12454C as defined in ASTM D 1784 except that D.I.P and C-900-97 with minimum SDR 18, shall be used as required by regulatory agencies or as otherwise noted in the contract documents. Rubber sealing rings for pipe joints shall meet the requirements of ASTM D 1869. No solvent welded pipe will be permitted.

1. In addition to the above requirements, pipe shall also conform to the following tests:

a. Drop Impact Test in accordance with ASTM D 2444.

b. Pipe Stiffness Test in accordance with ASTM D 2412.

c. Acetone Immersion Test in accordance with ASTM D 2152.

B. PVC plastic gravity sewer pipe shall be as manufactured by Johns-Manville, Certain-Teed Products Corporation, Contech Construction Products, or approved equal. Prior to delivery of PVC plastic pipe to the jobsite, the CONTRACTOR shall furnish the ENGINEER complete shop drawing data from the manufacturer of the type of PVC pipe and fittings the CONTRACTOR proposes to install.

C. Ductile iron pipe shall be epoxy lined and conform to ANSI/AWWA C151/A21.51 and C150/A21.50.

1. D.I.P. pipe shall conform with pressure class 350 for four (4) inch through twenty-four (24) inch.

PART 3 - EXECUTION

3.1 SEWER INSTALLATION

A. All sewer pipes shall be true to line and grade with bells up grade. The sections of the pipe shall be so laid and fitted together that when complete, the sewer shall have a smooth and uniform invert. The pipe shall be maintained clean. All pipe shall be free from defects. Trenches shall be kept dry while the pipe is being laid.

B. Bedding of flexible pipe with pipe stiffness less than 150 psi. shall be ASTM C33 #67 rock or better, requiring the bottom of the trench to be shaped to fit the bottom of the pipe for distance equal to one-half of the outside diameter of the pipe. Bell holes shall be deep enough to insure proper bearing of the pipe barrel on the bedding.

C. All joints shall be carefully fitted so as to ensure a tight waterproof joint. Joints shall not be covered until approved by the ENGINEER. The exposed end of all pipe shall be protected so as to prevent dirt or other debris from entering the pipe. Pipes shall be thoroughly flushed at the completion of the work.

D. PVC SDR 26 shall be installed per ASTM D2321 with Class I embedment material. PVC SDR 18 C-900 shall be installed per AWWA C-605.

E. A minimum pipe cover of thirty (30) inches is required for D.I.P. and thirty-six (36) inches for PVC pipe, unless otherwise shown on the plans or approved by the ENGINEER. C-900 with minimum SDR 18 is required for gravity sewer main installation greater than twelve (12) feet deep.

3.2 SERVICE LATERAL CONNECTIONS

A. All connections which are for future use shall be properly capped. No pipe shall be cut for connections unless approved by the ENGINEER. Wyes for service connections shall be installed as shown on the plans. The upper end of service connections shall be laid

at a depth not less than thirty-six (36) inches nor more than forty-eight (48) inches below finish grade elevation.

3.3 TESTS

A. After the joints have been inspected and approved, backfilling may be done until backfilled to one (1) foot over the crown of the pipes. Backfilling shall be in accordance with Section 02221 of these Specifications.

B. After backfilling gravity sewers to the aforesaid level, the ENGINEER and a representative of the OWNER will "lamp" the lines between maintenance access structures. If this alignment is true and no pipes are broken or misaligned, the backfilling shall be completed.

C. Tests for watertightness of gravity sewers shall be made by the CONTRACTOR in the presence of the ENGINEER. The sewer and connections shall not leak under the normal exterior ground water pressure at a rate in excess of 100 gallons per inch of diameter per mile per 24 hours for any section of line. Exfiltration from individual maintenance access structures shall not exceed four (4) gallons in 24 hours. A maximum run of three maintenance access structures (M.A.S.) may be used per test.

D. Where the crown of the pipe is below the natural ground water table at the time and place of testing, the pipe shall be tested for infiltration. Suitable watertight plugs shall be installed and sections of pipe to be tested shall be pumped dry before start of the test. Where the crown of the pipe is above the natural water table, the pipe shall be tested for exfiltration by installing necessary plugs and filling pipes and maintenance access structures with water and maintaining a static head of water of two feet above the crown of the pipe during the test. Exfiltration tests shall be conducted on gravity lines, building and house lateral lines, unless waived by the ENGINEER. With sanitary sewers, the water level or internal pressure to be used for exfiltration tests shall be determined by the ENGINEER.

E. All visible leaks, regardless of results of infiltration tests, shall be repaired. All repairs shown necessary by the tests are to be made, broken or cracked pipe replaced, all deposits removed, the sewer left true to line and grade and entirely clean, free from lumps of cement, protruding gaskets, bulkheads, etc., and ready for use before final acceptance is made.

F. Repair of any defects found in the system are to be completed at the expense of the CONTRACTOR.

G. On sanitary sewers, final infiltration and exfiltration tests shall be made by the CONTRACTOR at the CONTRACTOR’s expense after all backfilling operations and pavement restorations are completed and the sewers are cleaned and ready for use.

H. The ENGINEER shall maintain a record showing date and time of inspection, calculation of allowable exfiltration or infiltration and amount of measured exfiltration or infiltration.

I. All flexible pipe (pipe stiffness less than 150 psi) shall be tested with a nine (9) arm mandrel, sized to 95% of the average inside diameter. The mandrel test shall be performed no earlier than thirty (30) days, after reaching final trench backfill grade. The mandrel shall be hand pulled by the CONTRACTOR through all sewer mains. Any section of the sewer not passing the mandrel test shall be uncovered and the CONTRACTOR shall replace and recompact the embedment backfill material. These repaired sections shall be re-tested with the mandrel until passing. The Owner may also perform mandrel deflection tests within the one year warranty period. If any pipe fails the mandrel test during the warranty period unstable conditions or improper bedding will be assumed. The failed section(s) of pipe shall be removed and replaced at the sole expense of the CONTRACTOR. Such replaced sections shall be covered by a new warranty period of one year from the date of acceptance of the replaced section.

3.4 WARRANTY

A. Repair and replacement. Any repairs or replacement necessitated by mechanical failure due to faulty materials, improper installation or poor workmanship shall be completed within five (5) days after notification by the ENGINEER. At the expiration of this time, the OWNER shall be entitled to have work done by others at the expense of the CONTRACTOR. Such repair work done by others shall not void the warranty or the responsibility of the CONTRACTOR as to balance of the installation by the CONTRACTOR.

3.5 SEWER BY-PASS PUMPING AND FLOW CONTROL

A. The CONTRACTOR shall submit with the Schedule complete and detailed plans describing the CONTRACTOR's proposed method for manning and maintaining the flow control/by-pass pumping management 24-hours a day where and when necessary. The CONTRACTOR shall provide all necessary labor, pumps, piping and other equipment necessary to accomplish this task. By-pass or any other type of pump discharge shall be discharged into a working maintenance access structure or appropriate tank or tanker vehicle. The CONTRACTOR will be responsible for any fines or clean-up expenses incurred for any unlawful or improper discharge or spill.

3.6 GRAVITY SANITARY SEWERS (LIVE SYSTEMS)

A. Existing service laterals shall be connected to the newly constructed sewer sanitary gravity lines immediately following disconnection. Until the existing service laterals are con-

nected to the new system, the untreated sewage shall be treated/handled in an approved manner.

B. After the joints have been inspected by the ENGINEER or the OWNER and approved, backfilling may be done until backfill is one foot over the pipes. Backfilling shall be in accordance with Section 02221 of these Specifications.

C. After backfilling gravity sewers to the aforesaid level, the ENGINEER and a representative of the OWNER will "lamp" the lines between maintenance access structures. If this alignment is true and no pipes are broken or misaligned, the backfilling shall be completed.

D. Tests for water-tightness of gravity sewers shall be made by the CONTRACTOR in the presence of the ENGINEER. The sewer and connections shall be tested per BCWWS Minimum Standards, Rev. 4/2004, Section 8.04 B. Air Testing. The test shall comprise of all main line and lateral connections. Lateral connections shall be tested from the main line to the property line. The main lines and laterals shall utilize inflatable stoppers or approved plugs capable of withstanding the pressures of the test to isolate the main line section as well as the laterals to the property line.

E. Where the crown of the pipe is below the natural ground water table at the time and place of testing, the pipe shall be tested for infiltration. Suitable watertight plugs shall be installed and sections of pipe to be tested shall be pumped dry before start of the test. Where the crown of the pipe is above the natural water table, the pipe shall be tested for water tightness by the use of a low pressure air test per BCWWS Minimum Standards, 4/2044, Section 8.04 B. Air Testing. Air tests shall be conducted on gravity lines, building and house lateral lines

F. All visible leaks, regardless of results of infiltration tests, shall be repaired. All repairs shown necessary by the tests are to be made, broken or cracked pipe replaced, all deposits removed, the sewer left true to line and grade and entirely clean, free from lumps of cement, protruding gaskets, bulkheads, etc., and ready for use before final acceptance is made.

G. A video inspection of the gravity sanitary sewer main lines will be performed by the CITY after the first lift of rock is placed and compacted. The gravity sanitary sewer lines shall meet WWS criteria for allowable deflection.

H. The CONTRACTOR may video tape the sanitary sewer laterals from the main line to the property line in lieu of air testing or exfiltration testing the lateral after backfilling. This may be done only if requested by the CONTRACTOR in writing and approved by the ENGINEER and CITY. The costs of any video inspection of laterals and repairs required of the lateral shall be the sole responsibility of the CONTRACTOR. All video taping of laterals shall include the property address for identification purposes.

I. The video inspection of the sanitary sewer gravity lines, laterals and joints will be reviewed by the ENGINEER and CITY and all joints for tightness and abnormalities. If the ENGINEER or CITY determines a possible defect exists, excavation, inspection and

repair of any defects found in the system are to be completed at the expense of the CONTRACTOR.

J. The ENGINEER shall maintain a record showing date and time of inspection, calculation of allowable air loss or infiltration and amount of measured air loss or infiltration.

K. If the Contractor disputes any such claims of defect, it shall be the CONTRACTOR'S responsibility and expense to exfiltration test and or air test the line as to assure the integrity of the sanitary sewer gravity line, lateral or joint. The testing shall be arranged and coordinated to minimize any interruption to existing customers previously placed in service.

END OF SECTION 333000

SECTION 334100 - STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:

1. 033000 -Cast-in-place Concrete.
2. 312333 -Excavating, Backfilling, and Compaction for Utilities.

1.2 REFERENCES

A. The American Society for testing and Materials (ASTM):
1. A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. A74 - Specification for Cast Iron Soil Pipe and Fittings.
3. C131 - Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
4. C443 - Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
5. C564 - Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
6. D3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

B. The American Association of the State Highway Transportation Officials (AASHTO).

C. Florida Department of Transportation (FDOT), latest edition, Standard Specifications for Road and Bridge Construction.
1. Delete the basis of payment and other pay measurement requirements from FDOT specifications.
2. Payment for work specified in this section will be included as part of lump sum bid for entire project according to Construction Documents.

D. Delray Beach Minimum Design and Construction Standards.

E. Cast Iron Soil Pipe Institute.

1.3 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery and the like may be specified on the Drawings and not in the TECHNICAL SPECIFICATIONS. Such items shall be provided by the CONTRACTOR in accordance with the General Notes on the Drawings.

1.4 SUBMITTALS

A. Submit properly identified shop drawings and manufacturer's catalog cuts, technical data, and certificates on the following for review before starting work.
1. Precast concrete structures.
2. Frames and grates.
3. Pipe.
4. Test reports.

5. Plastic filter fabric.

B. Include manufacturer's certificates of compliance or certified analysis according to applicable standards with each shipment of material.

1.5 QUALITY ASSURANCE

A. Work shall be performed according to plans and specifications in a neat and accurate manner.

1.6 STORAGE

A. Keep materials, structures, equipment, and appurtenances stored on the site clean and free of foreign materials.

B. Replace damaged items at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. See materials as indicated in Drawings notes and details.

PART 3 EXECUTION

3.1 INSPECTION

A. Do not proceed with the work of this section until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.

3.2 INSTALLATION

A. Excavation and Backfilling for Trenches and Manholes: As specified in Section 02221-Excavating, Backfilling, and Compaction for Utilities.

B. Placing Pipe:
1. Carefully examine each pipe before laying. Do not use defective or damaged pipe.
2. Lay pipelines to grades and alignment indicated.
3. Provide proper facilities for lowering sections of pipe into trenches.
4. Inspect pipe in place before backfilling and remove and replace those damaged during placement at no cost to the Owner.
5. Storm Sewer Pipe:
   a. Shape bottom of trench by hand to give uniform circumferential support to lower one fourth of each pipe.
   b. Where applicable, lay pipe upgrade with tongue or spigot ends pointing in direction of flow.
   c. Lay each pipe true to line and grade indicated on drawings and in such a manner to form a close concentric joint with adjoining pipe and to prevent sudden offsets of flow line.

d. Keep interior of storm sewer free of dirt and superfluous materials as work progresses.
e. Keep a suitable swab or drag in pipe where cleaning after laying is difficult due to small pipe size and pull forward past each joint immediately after each jointing has been completed.
f. If maximum width of trench at top of pipe as specified is exceeded, install either concrete cradling, pipe encasement or other bedding as may be required to support added load of backfill.
g. Keep trenches for sections of sewer free from water until pipe-jointing material has set and trench backfilled.
h. Do not lay pipe when condition of trench or weather is unsuitable for such work.
i. Keep open ends of pipes and fittings securely closed at times when work is not in progress.
j. If pipe cannot be adequately supported on undisturbed earth or tamped backfill, encase pipe in concrete or support it on a concrete cradle.

C. Concrete Structure:
1. Concrete structures shall be constructed according to plans and as specified on Concrete Work - Division 03300, excavation and backfill as specified in Section 02221 - Excavating, Backfilling, and Compaction for Utilities, DCPW, and as indicated on the drawings.
2. Leveling courses at structures for manholes and catch basins shall be 3 to 12 inches and according to DCPW SD4.5.

D. Catch Basins and Manholes: Frames and Inlet Grates or Solid Covers: Set the cast iron frames and grates in a bed or mortar and carefully adjust to elevations shown on the drawings.

3.3 CLEAN UP

A. If drainage well has been used for disposal of water from dewatering operation, upon completion of dewatering clean out the detention tank and perform capacity tests as specified to insure that the disposal well is capable of disposing of storm water as indicated on drawings and specified in this Section.

END OF SECTION 334100

SECTION 334200 DEWATERING

PART 1 GENERAL

1.1 DESCRIPTION

A. The work to be completed under this section includes the requirements for temporary dewatering or groundwater control for the demolition and construction of proposed pools and associated structures.

B. Dewatering for utilities is not included in this Section.

1.2 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Geotechnical reports provided in the bid documents.

C. South Florida Water Management District Temporary Dewatering Permit Documents by General Contractor.

D. Any other associated permit documents as applicable.

1.3 REFERENCES

PART 2 CRITERIAL FOR BIDDING

2.1 BID PACKAGE

A. In addition to the provided Bid Form the Subcontractor shall prepare and submit a dewatering plan for review. See PART 3. SUBMITTALS, Section 1 for details.

B. Subcontractor must provide five completed work references for similar projects in the immediate area. Project references shall include project name, a description of the work, location as well as contact information if available.

C. Provide a unit price for fueling services. This will be used for backup equipment during a 24-hour test period.

2.2 Whereas groundwater elevations may be higher than indicated in the provided Geotechnical Report the Subcontractor acknowledges no additional payment or extension of time will be granted for such reason.

2.3 The Subcontractor acknowledges that existing subsurface construction debris may be present and has accounted for this potential condition. Additionally, the subcontractor acknowledges that a significant layer of bedding stone and/or gravel may exist beneath the existing pool structures.

2.4 Subcontractor agrees that this is a performance specification.

2.5 Alarm system. Subcontractor shall provide an operation cellular alarm system capable of sending phone calls or text messages for the following events:

A. High water alarm.

B. Loss of flow.

C. Shut down of primary pump.

PART 3 SUBMITTALS

3.1 DEWATERING PLAN

A. For each area, the Subcontractor shall provide a detailed dewatering plan for review identifying all piping routes, pumps, valves, sediment tanks, turbidity curtains and associated accessories.

B. Identify sediment tank, pump, header and discharge pipe sizes.

C. Provide a list of electrical requirements, if applicable.

D. Provide a list of backup equipment.

E. Provide a written description of the sequence of work including durations.

3.2 EMERGENCY CONTACT LIST

A. Provide a list of key employee contact information including cellular phone numbers.

B. List to include. Project manager, Superintendent and Foreman as applicable.

PART 4. EXECUTION

4.1 Subcontractor shall provide sufficient equipment to lower the groundwater table inside the proposed cofferdam to a level not less than one foot below the bottom of any excavation.

4.2 Subcontractor has included as many mobilizations as required to install and maintain a functioning dewatering system for areas of work described herein.

4.3 Subcontractor acknowledges that producing clean dewatering effluent is a paramount concern. Discharge to drainage wells is expected to have a limited capacity and the vast majority of the effluent must be routed offsite. As such turbidity levels must be recorded daily and reported weekly to South Florida Water Management District.

4.3 Test Period. Prior to approval of the dewatering system the Subcontractor shall demonstrate the following to the satisfaction of the CONTRACTOR:

A. Water table has been lowered a minimum of one foot below the bottom of proposed excavation.

B. The backup pump system has run successfully for 24 hours continuously.

C. The cellular alarm system has been tested to operate satisfactorily.

END OF SECTION

(2) Model PH-215-TT
460V, 3 Phase

Description of Operation

The SYMBIONT™ Geo-Thermal Pool Heater is a high quality, high performance, dedicated water-to-water package heat pump.

The SYMBIONT™ is designed to provide high performance operation on private and public pools and spas. Like gas, the SYMBIONT™ is totally unaffected by outdoor weather conditions and has a 15-20 year serviceable life expectancy.

The SYMBIONT™, while competitively priced with either solar heating systems or air source heat pumps, costs substantially less to operate than any air source available. When cost of operation and dependability are considered, the SYMBIONT™ has no equal.

When the pool pump is running, and on demand of the thermostat, the SYMBIONT™ pool heater and source water pump are energized to heat the pool.

Like any heat pump, the SYMBIONT™ uses a refrigerant vapor compression cycle to extract free heat from one place (the heat source, either a well, a lake, or canal) and deliver it to another (the pool or spa). All you pay for is the electricity used by the compressor and pumps.

Features

- Modular Design with Easy Piping and Wiring Access
- Painted Aluminum Cabinets with Raised-Base Aluminum Chassis
- Insulated for Quiet Operation
- High Efficiency Scroll Compressor with Inherent Motor-Protector
- Titanium Tube-Shell Heat Exchangers
- Refrigerant Liquid Receiver and Filter/Dryer
- Refrigerant Sight-Glass with Moisture Indicator
- Thermostatic Expansion Valve
- High and Low Pressure Switches
- Time Delay Compressor Protectors
- Electronic Digital Pool/Spa Thermostat
- Factory Installed Reverse-Cycle Summer Pool Cooling
- ARL or ETL Listed/Approved

Specifications*

Source EWT (Entering Water Temp)	65F	75F
BTUH Rating	199,014	221,545
COP	6.07	6.62
Source Water/Pool Water GPM	50	
Source Water Connections FPT	2"	
Compressor	13 HP	
Volts/Hertz/Phase	~~208-230/60/3~~	460/60/3
RLA	~~51.3~~	23
LRA	~~300~~	150
Minimum Circuit Ampacity	~~64.1~~	28.8
Maximum Breaker	~~100~~	50
Weight	520 lbs.	
Length/Width/Height	60" x 34" x 40"	

4372 North Access Road, Englewood, FL 34224, (941) 474-9306, (800) 881-4328, Fax (941) 473-9306
* Specifications subject to change. May 1, 2018

(2) Model PH-300-TT
460V, 3 Phase

Description of Operation

The SYMBIONT™ Geo-Thermal Pool Heater is a high quality, high performance, dedicated water-to-water package heat pump.

The SYMBIONT™ is designed to provide high performance operation on private and public pools and spas. Like gas, the SYMBIONT™ is totally unaffected by outdoor weather conditions and has a 15-20 year serviceable life expectancy.

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- Refrigerant Liquid Receiver and Filter/Dryer
- Refrigerant Sight-Glass with Moisture Indicator
- Thermostatic Expansion Valve
- High and Low Pressure Switches
- Time Delay Compressor Protectors
- Electronic Digital Pool/Spa Thermostat
- Factory Installed Reverse-Cycle Summer Pool Cooling
- ARL or ETL Listed/Approved

Specifications*

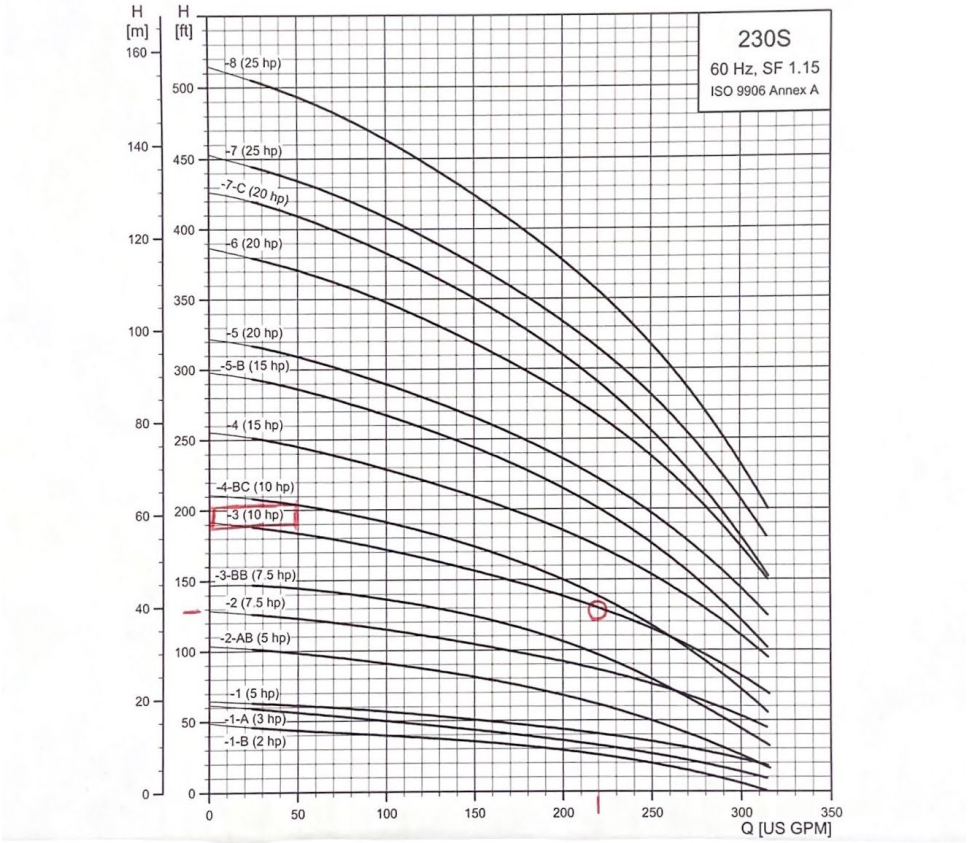
Source EWT (Entering Water Temp)	65F	75F
BTUH Rating	274,225	309,642
COP	5.46	5.99
Source Water/Pool Water GPM	70/50	
Source Water Connections FPT	2"	
Compressor	20 HP	
Volts/Hertz/Phase	~~208-230/60/3~~	460/60/3
RLA	~~63.7~~	30
Minimum Circuit Ampacity	~~79.57~~	39.18
Maximum Breaker	~~100~~	70
Weight	971 lbs.	
Length/Width/Height	61" x 35" x 40"	

4372 North Access Road, Englewood, FL 34224, (941) 474-9306, (800) 881-4328, Fax (941) 473-9306
* Specifications subject to change. May 11, 2021

Grundfos SP 230S100-3
460V, 3-Phase
Submersible Pump

Curve charts and technical data
6” and larger wells - continued

SP 230S (230 gpm)



SP

7. Electrical data

Grundfos submersible pump motors - 60 Hz

Hp	Ph	Volt [V]	S.F.	Circuit breaker or fuses		Amperage		Full load		Max. thrust [lb]	Product number
				Std.	Delay	Start [A]	Max. [A]	Eff. [%]	PF [%]		
6-inch, three-phase motors											
7.5	3	208-230	1.15	65	40	114 - 130	23.4 - 27.5	81	85 - 84	6070	96166181
7.5	3	460	1.15	30	17	68	13.2	81	85	6070	96166161
7.5	3	575	1.15	30	17	51	10.2	81	85	6070	96166141
10	3	208-230	1.15	90	50	126 - 142	30.0 - 37.5	82	86 - 84	6070	96166182
10	3	460	1.15	40	25	75	17.4	82	85	6070	96166162
10	3	575	1.15	40	25	56.5	13.4	82	85	6070	96166142
15	3	208-230	1.15	130	75	198 - 224	44.5 - 53.5	83	86 - 84	6070	96166184
15	3	460	1.15	60	35	112	25	83	84	6070	96166164
15	3	575	1.15	60	35	84	19.4	83	84	6070	96166144

Symbiont Geothermal
System for Pools

(2) 8” steel wells drilled to the aquifer (approximately 150’ deep)

(1) 6” 10hp Grundfos SS submersible well pump

(1) Yaskawa Variable Frequency Drive installed to control the well pump

(2) Symbiont PH-300-TT-RV units for the Family Pool

(2) Symbiont PH-215-TT-RV units for the Competition Pool

(2) Welded Aluminum (engineered) racks to support the PH-215 units above the PH-300 units

All well water piping and fittings will be rigid Schedule 40 PVC

All pool and well water manifold piping at the units will be rigid Schedule 40 PVC

There will be 2” Spears ball valves with Viton seals for isolation on all inlets, and outlets, for the units.

Manifold piping will be supported by strut and strut clamps.

Brass pressure/temperature ports will be installed for balance, and service purposes.

Six-month post-installation courtesy inspection

One year Symbiont Service Corp all parts and labor warranty on the installation

Five-year manufacturer’s all labor warranty on the Symbiont units

Seven-year manufacturer’s all parts warranty on the Symbiont units

Lifetime parts warranty on the Titanium parts of the condenser and evaporator heat exchangers

Symbiont Service Corp offers preventative maintenance programs.

Symbiont’s highly trained service department will be there to keep the system running.

Symbiont techs are experts on all aspects of the system (the heat pump units, pool equip, wells & well pumps, electrical, etc.)

Note: Provide as noted or approved equal with same warranties.

END OF SECTION