CONTRACT DOCUMENTS

AND

SPECIFICATIONS

FOR

PROJECT NO. SP 19-1 REED PARK POOL AND WATER PLAYGROUND RECONSTRUCTION

ATTENDANCE AT PRE-BID CONFERENCE IS MANDATORY

PREPARED BY:
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CITY OF Tulsa
A New Kind of *Energy*™

PAUL D. ZACHARY, P.E., DIRECTOR
ENGINEERING SERVICES DEPARTMENT

Account Numbers: 147120.Bldgs41.405.4054111-541104; 147120.Bldgs31.405.4053122-541104; 147190.LandImp.5455301.6014.4054111-541101

Engineering Services Department
2317 South Jackson Avenue
Tulsa, Oklahoma 74107
(918) 596-9565

VOLUME II

DOCUMENT 00 0001 – PROJECT DIRECTORY

OWNER:	City of Tulsa, Oklahoma Engineering Services Department Tulsa, Oklahoma
LANDSCAPE ARCHITECT:	Alaback Design Associates 3202 East 21st Street Suite 100 Tulsa, Oklahoma 74114
ARCHITECT:	GH2 Architects, LLC 320 South Boston Avenue, Suite 1600 Tulsa, Oklahoma 74103
CIVIL ENGINEER	CEC Corporation. 4617 E 91st St. Tulsa, Oklahoma 74137
STRUCTURAL ENGINEER:	360 Engineering Group, PLLC 1201 East 3rd Street Tulsa, OK 74120
ELECTRICAL ENGINEER:	EDA + FKI 10610 E. 45th Street, Suite 201 Tulsa, Oklahoma 74146
MECHANICAL ENGINEER:	EDA + FKI. 10610 E. 45th Street, Suite 201 Tulsa, Oklahoma 74146
POOL CONSULTANT:	Water Technology Inc. 100 Park Avenue, P.O. Box 614 Beaver Dam, Wisconsin 53916

END OF SECTION 00 0001

DOCUMENT 00 0010 – TABLE OF CONTENTS

VOLUME 2

DIVISION 0 – BIDDING REQUIREMENTS AND CONTRACT FORMS

00 0001 PROJECT DIRECTORY
00 0010 TABLE OF CONTENTS
00 3132 GEOTECHNICAL DATA
Geotechnical Engineering Report (Available at the Landscape Architect's Office)

DIVISION 1 – GENERAL REQUIREMENTS

01 1000 SUMMARY
01 2100 ALLOWANCES
01 2200 UNIT PRICES
01 2300 ALTERNATES
01 2500 SUBSTITUTION PROCEDURES
01 2600 CONTRACT MODIFICATION PROCEDURES
01 2900 PAYMENT PROCEDURES
01 3100 PROJECT MANAGEMENT AND COORDINATION
Electronic Document Disclaimer and Indemnity Agreement
01 3200 CONSTRUCTION PROGRESS DOCUMENTATION
01 3233 PHOTOGRAPHIC DOCUMENTATION
01 3300 SUBMITTAL PROCEDURES
01 4000 QUALITY REQUIREMENTS
01 4200 REFERENCES
01 5000 TEMPORARY FACILITIES AND CONTROLS
01 5639 TEMPORARY TREE AND PLANT PROTECTION
01 6000 PRODUCT REQUIREMENTS
01 7300 EXECUTION
01 7419 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
01 7700 CLOSEOUT PROCEDURES
01 7823 OPERATION AND MAINTENANCE DATA
01 7839 PROJECT RECORD DOCUMENTS
01 7900 DEMONSTRATION AND TRAINING

DIVISION 2 – EXISTING CONDITIONS

02 4119 SELECTIVE STRUCTURE DEMOLITION

DIVISION 3 – CONCRETE

03 3000 CAST-IN-PLACE CONCRETE

DIVISION 4 – MASONRY

04 2200 CONCRETE UNIT MASONRY
04 2300 GLASS UNIT MASONRY

DIVISION 5 – METALS

05 1200 STRUCTURAL STEEL FRAMING
05 5000 METAL FABRICATIONS
05 5213 PIPE AND TUBE RAILINGS

DIVISION 6 – WOOD, PLASTICS AND COMPOSITES

06 1000 ROUGH CARPENTRY
06 1600 SHEATHING
06 1753 SHOP FABRICATED WOOD TRUSSES

DIVISION 7 – THERMAL AND MOISTURE PROTECTION
07 1700 BENTONITE WATERPROOFING AND SLAB INSULATION
07 1900 WATER REPELLENTS
07 2100 THERMAL INSULATION
07 4113 METAL ROOF PANELS
07 4213 METAL WALL PANELS
07 6200 SHEET METAL FLASHING AND TRIM
07 9200 JOINT SEALANTS

DIVISION 8 – OPENINGS
08 1113 HOLLOW METAL DOORS AND FRAMES
08 3113 ACCESS DOORS AND FRAMES
08 3323 OVERHEAD COILING DOORS
08 7100 DOOR HARDWARE
08 8000 GLAZING
08 9119 FIXED LOUVERS

DIVISION 9 – FINISHES
09 2900 GYPSUM BOARD
09 6513 RESILIENT BASE AND ACCESSORIES
09 8000 SPECIAL COATINGS
09 9113 EXTERIOR PAINTING
09 9123 INTERIOR PAINTING

DIVISION 10 – SPECIALTIES
10 1400 SIGNAGE
10 1710 COMPARTMENTS AND CUBICLES
10 2800 TOILET ACCESSORIES
10 4100 PROTECTION SPECIALTIES

DIVISION 11 – EQUIPMENT
11 6800 WATER PLAYGROUND EQUIPMENT

DIVISION 12 – FURNISHINGS
12 3616 STAINLESS STEEL COUNTERTOPS
12 9300 SITE FURNISHINGS

DIVISION 13 – SPECIAL CONSTRUCTION
13 1113 POOL GENERAL
13 1114 POOL START-UP, MAINTENANCE & OPERATIONS TRAINING
13 1118 POOL CONCRETE
13 1120 POOL AND PIPE FITTINGS
13 1123 POOL PIPE SUPPORTS
13 1124 POOL VALVES
13 1125 POOL CENTRIFUGAL PUMPS
13 1132 POOL FIBERGLASS FILTERS
13 1135 POOL ULTRAVIOLET DISINECTECTION EQUIPMENT
13 1137 POOL CHEMICAL SYSTEMS AND CONTROLS
13 1145 POOL RAIL GOODS
13 1146 POOL EQUIPMENT
13 1161 POOL CERAMIC TILE
13 1165 WATER FLUME RIDE

DIVISION 22 – PLUMBING
22 0517 SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
22 0518 ESCUTCHEONS FOR PLUMBING PIPING
22 0523.12 BALL VALVES FOR PLUMBING PIPING
22 0523.14 CHECK VALVES FOR PLUMBING PIPING
22 0523.15 GATE VALVES FOR PLUMBING PIPING
22 0529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
22 0553 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
22 0719 PLUMBING PIPING INSULATION
22 1113 FACILITY WATER DISTRIBUTION PIPING
22 1116 DOMESTIC WATER PIPING
22 1313 PRIVATE SANITARY SEWERAGE
22 1316 SANITARY WASTE AND VENT PIPING
22 1319 SANITARY WASTE PIPING SPECIALTIES
22 1319.13 SANITARY DRAINS
22 3400 FUEL-FIRED, DOMESTIC-WATER HEATERS
22 4213.13 COMMERCIAL WATER CLOSETS
22 4213.16 COMMERCIAL URINALS
22 4216.13 COMMERCIAL LAVATORIES
22 4216.16 COMMERCIAL SINKS
22 4223 COMMERCIAL SHOWERS
22 4500 EMERGENCY PLUMBING FIXTURES
22 4716 DRINKING FOUNTAINS

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING
23 0513 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 0517 SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
23 0523.12 BALL VALVES FOR HVAC PIPING
23 0523.14 CHECK VALVES FOR HVAC PIPING
23 0523.15 GATE VALVES FOR HVAC PIPING
23 0523.16 PLUG VALVES FOR HVAC PIPING
23 0529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
23 0553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 0593 TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 1123 FACILITY NATURAL-GAS PIPING
23 3113 METAL DUCTS
23 3116 NONMETAL DUCTS
23 3300 AIR DUCT ACCESSORIES
23 3416 CENTRIFUGAL HVAC FANS
23 3713.13 AIR DIFFUSERS
23 3713.23 AIR REGISTERS AND GRILLES
23 5533.16 ELECTRIC UNIT HEATERS

DIVISION 26 – ELECTRICAL
26 0519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 0529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 0533 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
26 0543 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS
26 0544 SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 2416 PANELBOARDS
26 2726 WIRING DEVICES
26 2816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

26 5100 INTERIOR LIGHTING

DIVISION 27 – COMMUNICATIONS
27 0528 PATHWAYS FOR COMMUNICATIONS SYSTEMS

DIVISION 31 – EARTHWORK
31 1000 SITE CLEARING
31 2000 EARTH MOVING
31 3116 TERMITE CONTROL

DIVISION 32 – EXTERIOR IMPROVEMENTS
32 1313 CONCRETE PAVING
32 1316 DECORATIVE CONCRETE PAVING
32 1373 CONCRETE PAVING JOINT SEALANTS
32 9200 SODDING

DIVISION 33 – UTILITIES
33 4100 STORM UTILITY DRAINAGE PIPING

END OF SECTION 00 0010

DOCUMENT 00 3132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA AND GEOTECHNICAL INVESTIGATION REPORT

A. This document with its referenced attachments is not part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to inform of design criteria. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions, interpretations, or recommendations. This Document and all attachments are not part of the Contract Documents.

A. Soil-boring data for Project, based upon borings obtained by Terracon Consultants, Inc. dated August 22, 2019, is available for viewing at the Architect's or Engineer's offices.

B. A geotechnical investigation report for Project, prepared by Terracon Consultants, Inc. dated August 22, 2019, is available for viewing at the Architect's or Engineer's offices.

1. Contractor is expected to examine the site and all geotechnical data and investigation reports and then decide for himself the character of the materials to be encountered. Contractor shall employ a consultant qualified to interpret the geotechnical data and investigation reports if the Contractor does not feel qualified to interpret any part of the geotechnical data and investigation reports.
2. The Owner, Tenant, Architect, and Architect's Consultants disclaim any responsibility for the accuracy, true location and extent of the geotechnical data and investigation reports that have been prepared by others. They further disclaim responsibility for interpretations and recommendations related to that data by Bidders, such as, but not limited to, predicting soils bearing values or the depth to soils bearing materials, rock profiles or hardness, soils stability and the presence, level and extent of underground water.

END OF SECTION 00 3132

SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Work under separate contracts.
5. Owner-furnished products.
6. Access to site.
7. Coordination with occupants.
8. Work restrictions.
9. Specification and drawing conventions.

B. Related Requirements:
1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Tulsa Parks Department Reed Park Pool and Water Playground Reconstruction – SP19-1
1. Project Location: Reed Park, 4233 S Yukon Ave., Tulsa, Oklahoma 74107

B. Contract Documents were prepared by Alaback Design Associates and include the following:
1. Specifications: 2 volumes
2. Drawing Set: Construction Documents

C. Owner: City of Tulsa

D. Project Information Management Software: Project Information Management Software administered by Architect will be used for purposes of managing communication and transferring documents during the construction stage.
1. See Division 01 Section "Project Management and Coordination" for requirements for using the software.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
1. Site demolition, improvements and utilities, building demolition, architectural, structural, mechanical, electrical, and plumbing.

B. Type of Contract:
1. Project will be constructed under a single prime contract.

1.5 WORK BY OWNER

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

B. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
   1. Installation of furniture, data, communication, security, audio and visual components.

1.6 WORK UNDER SEPARATE CONTRACTS

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

B. Subsequent Work: Owner will award separate contract(s) for the following additional work to be performed at site following Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
   1. Installation of furniture, data, communication, security, audio and visual components.

1.7 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.

B. Owner-Furnished Products:
   1. As indicated on drawings.

1.8 ACCESS TO SITE

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

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated below and on the Site Access Exhibit included within the Bid Package. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Limits: Confine construction operations to areas in which the Work is to be performed.
   2. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.9 COORDINATION WITH OCCUPANTS

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

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

1.10 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: No limit unless otherwise indicated.
1. Early Morning Hours: Refer to General Conditions (7am to 7pm)
2. Hours for Utility Shutdowns: Coordinate with Owner.
3. Hours for Core Drilling and Demolition: Coordinate with Owner.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
1. Notify Owner not less than two weeks in advance of proposed utility interruptions.
2. Obtain Owners written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking on Project site is not permitted.

F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

3. Keynoting: Materials and products may be identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

SECTION 01 2600 - ALLOWANCES

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. Refer to bid proposal form for additional information.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Allowances.

1.3 WORK COVERED BY ALLOWANCES

A. An Allowance as listed on the Bid Proposal Form has been provided in the contract for Work not identified in the Bidding Documents.

B. The Allowance shall be used for the cost of materials, labor, installation, and overhead and profit for additional work required or requested by the Owner, which is not identified in the Construction Documents, and not included in the Base Bid.

C. The Allowance shall be used only at the discretion of the City of Tulsa.

D. Provide, to the City of Tulsa Representative, a written request for the use of the allowances, with a schedule of values, and associated backup information.

E. Proceed with Work included in the allowances only after receiving a written order, from the City of Tulsa Representative, authorizing such work. Proceeding with Work in the allowance without a written order from the City of Tulsa Representative will be at the Contractor's cost.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2100

SECTION 01 2200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to bid proposal form for additional information.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for unit costs.

1.3 DEFINITIONS

A. Unit cost is an amount proposed by bidders, stated on the Bid Proposal Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

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

B. Measurement and Payment: Refer to Bid Proposal Form for description of Work that requires establishment of unit costs. Methods of measurement and payment for unit costs are specified on the Bid Proposal Form, General Conditions, and section 01 2900 Payment Procedures.

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

D. List of Unit Costs: A list of unit costs is included on the Bid Proposal. Specification Sections included in the Project Manual contain requirements for materials and systems described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT COSTS

A. Refer to Bid Proposal Form.

END OF SECTION 01 2200

SECTION 01 2300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
   2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of Alternate.
   2. Include as part of each alternate, all modifications and adjustments of adjacent Work as necessary to completely and fully integrate Alternate into the project.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

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

D. Schedule: A schedule of alternates is included within the Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

A. END OF SECTION 01 2300

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Division 01 Section "Alternates" for products selected under an alternate.
   2. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
   3. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitutions during Bidding will be reviewed by the Architect up to ten (10) calendar days prior to the bid date. Substitutions must be made using the Substitution Request Form located at the end of this Section and submitted by a Contractor. Substitutions submitted by entities other than a Contractor will not be considered.
   2. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   3. A request constitutes a representation that the Contractor:
      a. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
      b. Will provide the same or greater warranty for the Substitution as for the specified Product.
      c. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the Owner.
      d. Waives claims for additional costs or time extension which may subsequently become apparent.
      e. Contractor shall reimburse Owner for costs of additional architectural services necessitated by proposed substitutions submitted after Award of Contract.
      f. In the event substitutions are proposed after Award of Contract, the Architect will bill for all time used by the Architect and Architect's consultants in evaluating each such proposed substitution whether or not Architect approves a proposed substitution.
   4. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

1.4 ACTION SUBMITTALS

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

1. Substitution Request Form: Use facsimile of form provided in Project Manual.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.
    g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    i. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
    j. Cost information, including a proposal of change, if any, in the Contract Sum.
    k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
    l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation. Architect will notify Contractor of acceptance or rejection of proposed substitution.
    a. Use product specified if Architect does not issue a decision on use of a proposed substitution within time indicated in the Invitation to Bid.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

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

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

a. Substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

b. Requested substitution is consistent with the Contract Documents and will produce indicated results.

c. Requested substitution provides sustainable design characteristics that specified product provided.

d. Substitution request is fully documented and properly submitted.

e. Requested substitution will not adversely affect Contractor's construction schedule.

f. Requested substitution has received necessary approvals of authorities having jurisdiction.

g. Requested substitution is compatible with other portions of the Work.

h. Requested substitution has been coordinated with other portions of the Work.

i. Requested substitution provides specified warranty.

j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

SECTION 01 2600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:
1. Division 01 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

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

1.4 PROPOSAL REQUESTS

A. Owner or Architect-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to the Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Owner will issue a Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2600

SECTION 01 2900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:
   1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with continuation sheets.
      b. Submittal schedule.
      c. Items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange schedule of values consistent with format of AIA Document G703.
   3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.

d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value of all labor, materials, and equipment as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a column in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. Include photographs of stored materials and evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. General overhead and profit, temporary facilities, and other major cost items that are not direct cost of actual work-in-place shall be shown as separate line items in the schedule of values.
9. Schedule Updating: Update and submit the schedule of values with the next Application for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Field Engineering and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

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

C. Payment Application Times: Submit Application for Payment to Field Engineering the same day each month. The period covered by each Application for Payment is one month, ending on the last day of the previous month.

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

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Field Engineering will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
   4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as photographs of the materials in their stored location and paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   3. Provide summary documentation for stored materials indicating the following:
      a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
      b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
      c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Field Engineering by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule (preliminary if not final).
   4. Submittal schedule (preliminary if not final).
   5. Copies of building permits.
   6. Certificates of insurance and insurance policies.
   7. Performance and payment bonds.

J. Application for Payment at Substantial Completion: Prior to the issuance of the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

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

2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
5. AIA Document G707, "Consent of Surety to Final Payment."
6. Evidence that claims have been settled.
7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
8. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2900

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. Requests for Interpretation (RFIs).
   4. Project Information Management Software.
   5. Project meetings.

B. Related Requirements:
   1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. Requests for Interpretation: A formal process used during the bidding and construction phases to facilitate communication between the Contractor and the Architect with regard to requests for additional information and clarification of the intent of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Prior to starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list office and cellular telephone numbers and e-mail addresses.

1.5 GENERAL COORDINATION PROCEDURES

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

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

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

C. Digital Data Files: Contractor shall submit a request for files using the Electronic File Release Form included at the end of this Section including all drawings requested. Upon receipt of the completed Electronic File Release Form, arrangements will be made to transfer the requested files to the Contractor.
1. Architect will furnish Contractor one set of digital data files of Drawings via the Architect's Project Information Management software for use in preparing coordination digital data files.
   a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

1.6 REQUESTS FOR INTERPRETATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI on the form included in this Section.
1. Architect will not respond to requests for interpretation unless this format is utilized and all appropriate information is provided.
2. Where RFI form does not provide adequate space for complete information, additional sheets may be attached.
3. Submit one request per form via email.
4. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
5. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
6. Architect's response shall not be considered as a Change Order or Change Directive, nor does it authorize changes in the Contract Sum or Contract Time.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
2. Project number.
3. Date.
4. Name of Contractor submitting the RFI.
5. RFI subject.
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. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. Architect's Action: Architect will review each RFI, determine action required, and respond with reasonable promptness.
1. The following Contractor-generated RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response may be affected.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, the Architect shall be notified in writing.

D. On receipt of Architect's action, Contractor shall immediately distribute the RFI response to affected parties. Review response and notify Architect within seven calendar days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: Contractor shall schedule meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Contractor shall Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
4. Owner requires that the contractor's owner or contractor's project manager and each subcontractor or other entity concerned, with the authority to make decisions for the project, be present at all project meetings.

B. Preconstruction Conference: Owner shall schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect.
1. Conduct the conference to review responsibilities and personnel assignments.

2. Attendees: Authorized representatives of Owner and Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Tentative construction schedule.
   b. Phasing.
   c. Critical work sequencing and long-lead items.
   d. Designation of key personnel and their duties.
   e. Lines of communications.
   f. Procedures for processing field decisions and Change Orders.
   g. Procedures for RFIs.
   h. Procedures for testing and inspecting.
   i. Procedures for processing Applications for Payment.
   j. Distribution of the Contract Documents.
   k. Submittal procedures.
   l. Preparation of record documents.
   m. Use of the premises and existing building.
   n. Work restrictions.
   o. Working hours.
   p. Owner's occupancy requirements.
   q. Responsibility for temporary facilities and controls.
   r. Procedures for moisture and mold control.
   s. Procedures for disruptions and shutdowns.
   t. Construction waste management and recycling.
   u. Parking availability.
   v. Office, work, and storage areas.
   w. Equipment deliveries and priorities.
   x. First aid.
   y. Security.
   z. Progress cleaning.
4. Minutes: Owner shall record and distribute meeting minutes.

C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect & Owner of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information. Including Architect and Owner.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Contractor shall schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 60 days prior to the scheduled date of Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, Contractor and its superintendent and other concerned parties shall attend the meeting. Participants at the

meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
   a. Preparation of record documents.
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
   c. Submittal of written warranties.
   d. Requirements for preparing operations and maintenance data.
   e. Requirements for delivery of material samples, attic stock, and spare parts.
   f. Requirements for demonstration and training.
   g. Preparation of Contractor's punch list.
   h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
   i. Submittal procedures.
   j. Owner's partial occupancy requirements.
   k. Installation of Owner's furniture, fixtures, and equipment.
   l. Responsibility for removing temporary facilities and controls.
4. Minutes: Contractor shall record and distribute meeting minutes.

E. Progress Meetings: Contractor shall conduct progress meetings at weekly intervals for the initial 100 calendar days and then at bi-weekly intervals.
   1. Coordinate dates of meetings with preparation of payment requests.
   2. Attendees: Representatives of the Owner, Architect, and Contractor shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
         1) Review schedule for next period.
      b. Review present and future needs of each entity present, including the following:
         1) Interface requirements.
         2) Sequence of operations.
         3) Status of submittals.
         4) Deliveries.
         5) Off-site fabrication.
         6) Access.
         7) Site utilization.
         8) Temporary facilities and controls.
         9) Progress cleaning.
         10) Quality and work standards.
         11) Status of correction of deficient items.
         12) Field observations.
         13) Status of RFIs.
         14) Status of proposal requests.
         15) Pending changes.
         16) Status of Change Orders.
         17) Pending claims, disputes, and cost over-runs.
         18) Documentation of information for payment requests.

4. Minutes: Contractor shall record and distribute the meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

ELECTRONIC DOCUMENT DISCLAIMER AND INDEMNITY AGREEMENT

The Electronic Documents listed below are furnished by Alaback Design Associates (ADA) for the convenience of **<CONTRACTOR COMPANY NAME>**. As consideration for ADA's agreement to release the Documents, Recipient, by execution of this Agreement or by using the Electronic Documents in any manner, including but not limited, to copying or using the Electronic Documents for reference, agrees to be bound by the terms of this Disclaimer and Indemnity Agreement. If Recipient does not agree to be bound, Recipient shall immediately return the Documents to ADA and shall make no use of them.

Recipient's use is at its own risk. ADA shall have neither a duty nor responsibility for the acts, errors, or omissions of Recipient or other consultant. It is the responsibility of the Recipient to independently determine, verify, and check the accuracy of all building code requirements, engineering calculations, measurements, quantities, dimensions and elevations prior to construction.

The Documents are furnished without warranty or guarantee, express, implied, or statutory, as to the accuracy, reliability, suitability, or fitness for a particular purpose. No Documents released under this Agreement will be signed or sealed. ADA reserves the right to remove the title block. The Documents may vary from any printed documents previously or subsequently released. ADA shall have no duty to identify variances with any printed, issued documents or update the Documents. ADA is not responsible for any errors caused by the transmission or by the Recipient's software or computer systems or use of the Documents.

The Recipient agrees, to the fullest extent permitted by law, to indemnify and hold harmless ADA, its officers, directors, employees and subconsultants against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising from or alleged to arise from the use of the Documents, including without limitation, damages, liabilities or costs (including reasonable attorneys' fees and defense costs) alleged to result from ADA's negligent acts, errors or omissions in connection with the Documents. In no event shall ADA be liable for, and Recipient expressly waives, the right to recover indirect or consequential damages as a consequence of the use or reuse of the Documents.

The Documents are and shall remain ADA's intellectual property and are not products. Delivery of the Documents shall not be deemed a transfer of ADA's intellectual property, including without limitation, any copyright. Under no circumstances shall delivery of the Documents to Recipient be deemed a sale by ADA, and no warranties, either express or implied, of merchantability and fitness for any particular purpose is given. Transfer of the Documents does not transfer any license to use the underlying software.

List of Documents for the 147510 / COT Whiteside Park Pool Reconstruction:

<XX>
<XX>

<CONTRACTOR COMPANY NAME>

By: _____ Date: _____

Printed Name: _____

SECTION 01 3200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's construction schedule.
   2. Construction schedule updating reports.
   3. Daily construction reports.
   4. Material location reports.
   5. Site condition reports.
   6. Special reports.

B. Related Requirements:
   1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
   2. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

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

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

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

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

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

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

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format using the Project Information Management Software defined in Section 01 3100:
1. PDF electronic file.
2. Up to three (3) paper copies may be submitted if the Contractor does not have the means by which to transmit electronic submittals.
a. One copy will be retained by the Architect and one copy will be retained by the Architect's Consultant. Other copies will be returned to the Contractor.
b. Number of copies exceeding three (3) will not be marked.

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

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

D. Daily Construction Reports: Contractor shall maintain reports at the jobsite and have them available for review by the Owner and Architect upon request.

E. Material Location Reports: Contractor shall maintain reports at the jobsite and have them available for review by the Owner and Architect upon request.

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

1.5 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than the actual duration of the activity, unless specifically allowed by Architect.

2. Procurement Activities: Include procurement process activities for long lead items and major items as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
3. Work Restrictions: Show the effect of the following items on the schedule:
   a. Coordination with existing construction.
   b. Partial occupancy before Substantial Completion.
   c. Use of premises restrictions.
4. Construction Areas: Identify each major area of construction for each major portion of the Work.
5. Weather Delays: See city working dates chart WDC-1

D. Milestones: Include milestones in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

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

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit a comprehensive, fully developed, horizontal, bar-chart-type, Contractor's construction schedule within 10 days of date established for commencement of the Work.

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to durations, actual starts and finishes, and activity durations.

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

END OF SECTION 01 3200

SECTION 01 3233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.

B. Related Requirements:
   1. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
   2. Division 01 Section "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
   3. Division 02 Section "Selective Structure Demolition" for photographic documentation before selective demolition operations commence.
   4. Division 31 Section "Site Clearing" for photographic documentation before site clearing operations commence.

1.3 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Contractor shall document pre-existing conditions and construction progress using a digital camera.
   1. Photograph Submittals: The Architect may request that photographs of conditions be submitted on occasion or to supplement a Request for Interpretation. Individual photographs may be electronically transmitted. Multiple photographs may be submitted using the Architect's Project Information Management Software.
   2. Identification: Provide the following information when submitting photographs for review:
      a. Name of Project.
      b. Name of Contractor.
      c. Date photograph was taken.
      d. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
   1. Date and Time: Include date and time in file name for each image.
   2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

B. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
   1. Flag construction limits before taking construction photographs.
   2. Take an adequate number of photographs to show existing conditions on and adjacent to the property including existing buildings on or adjoining property to accurately record physical conditions at start of construction.
   3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

C. Periodic Construction Photographs: Document construction progress weekly by taking an adequate number of photographs to demonstrate progress and show sequencing of Work. Select vantage points to show status of construction and progress since last photographs were taken.

END OF SECTION 01 3233

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:
   1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
   2. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
   3. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
   4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

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

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

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

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
   1. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.
      c. Name of subcontractor.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings for Contractor's use in preparing submittals may be obtained from the Architect for a fee.
   a. Contractor shall submit an Electronic File Release Form contained in this Section including drawings requested and digital format required. Architect will provide a fee schedule based on the request and files will be transferred upon receipt of payment from the Contractor.
   b. Architect's consultants may require additional file transfer agreements from the Contractor.
   c. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 10 business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Resubmittal Review: Allow 10 business days for review of each resubmittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
   1. Up to three (3) paper copies may be submitted if the Contractor does not have the means by which to transmit electronic submittals.
      a. One copy will be retained by the Architect and one copy will be retained by the Architect's Consultant. Other copies will be returned to the Contractor.
      b. Number of copies exceeding three (3) will not be marked.
   2. Indicate name of firm or entity that prepared each submittal on label or title block.
   3. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
   4. Include the following information for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Contractor.
      e. Name of subcontractor and supplier/manufacturer.
      f. Submittal number or other unique identifier, including revision identifier.
      g. Number and title of appropriate Specification Section.
      h. Drawing number and detail references, as appropriate.
      i. Location(s) where product is to be installed, as appropriate.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling and submit using a transmittal form. Architect will return without review submittals received from sources other than Contractor.
    a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
        1) Project name.
        2) Date.
        3) Destination (To:).
        4) Source (From:).
        5) Name and address of Architect.
        6) Name of Contractor.
        7) Names of subcontractor, manufacturer, and supplier.
        8) Category and type of submittal.
        9) Submittal purpose and description.
        10) Specification Section number and title.
        11) Remarks.
        12) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
    1. Assemble complete submittal package into a single indexed PDF file incorporating submittal requirements of a single Specification Section.
    2. All requirements for paper submittals apply to electronic submittals.
    3. Electronic submittals shall be submitted using the Architect's Project Information Management Software.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

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

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.

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

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
    1. Electronic Submittals: Submit electronic submittals via email as PDF electronic files.
        a. Architect will return annotated file and retain one copy of file as an electronic Project record document file.

2. Paper Submittals: Submit five paper copies of each submittal unless otherwise indicated. Anything in excess of five copies will be returned to the Contractor unmarked. Architect will return three annotated copies to the Contractor.
3. Informational Submittals: Submit one copy of each submittal unless otherwise indicated. Architect will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
    a. Manufacturer's catalog cuts.
    b. Applicable color charts.
    c. Statement of compliance with specified referenced standards.
    d. Testing by recognized testing agency.
    e. Application of testing agency labels and seals.
4. For equipment, include the following in addition to the above, as applicable:
    a. Wiring diagrams showing factory-installed wiring.
    b. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data concurrent with Samples.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    a. Identification of products.
    b. Compliance with specified standards.
    c. Notation of coordination requirements.
    d. Notation of dimensions established by field measurement.
    e. Relationship and attachment to adjoining construction clearly indicated.
    f. Seal and signature of professional engineer if specified.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.
3. Where electronic submittals are utilized, provide physical samples where material sample submittals are required. Photocopies of material and color samples are not acceptable.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

E. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

J. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

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

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

M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

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

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

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

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on

evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

T. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable.

2.2 DELEGATED-DESIGN SERVICES

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

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
   1. Reviewed: When Architect marks a submittal "Reviewed", the Work covered by the submittal may proceed provided it complies with the requirements of the Contract Documents. Final payment depends upon that compliance.
   2. Furnish as Corrected: When the Architect marks the submittal "Furnish as Corrected", the Work covered by the submittal may proceed provide it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends upon that compliance.

3. Revise and Resubmit: When the Architect marks a submittal "Revise and Resubmit", "Rejected", or "Submit Specified Item", do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark. Do not use, or allow others to use, submittals marked "Revise and Resubmit", "Rejected", or "Submit Specified Item" at the Project Site or elsewhere where Work is in progress.

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

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

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

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

END OF SECTION 01 3300

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

C. Related Requirements:
   1. Section 012100 – Summary
   2. Section 017300 – Execution

1.3 DEFINITIONS

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

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

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

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

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

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

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

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

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

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

1.4 CONFLICTING REQUIREMENTS

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

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

1.5 SUBMITTALS

A. Shop Drawings: For integrated exterior and laboratory mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
   1. Indicate manufacturer and model number of individual components.
   2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

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

C. Qualification Data: For testing agencies specified in "Quality Assurance" Article to determine their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
1. Project quality-control manager may also serve as Project superintendent.

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

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Contractor-performed tests and inspections cannot be performed by the special inspector.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents.

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

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

1.7 REPORTS AND DOCUMENTS

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

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

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

1.8 QUALITY ASSURANCE

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

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

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

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

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

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

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

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

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

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Owner, with copy to Contractor and to authorities having jurisdiction. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Special Inspector: Special Inspectors shall meet the more stringent of the qualifications listed in this section and the requirements listed in the Statement of Special Inspections submitted to the Authority Having Jurisdiction on this site or otherwise required by the Authority Having Jurisdiction.

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

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
   a. Allow seven days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

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

N. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work.

O. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.9 QUALITY CONTROL

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

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

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

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

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

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

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

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.

6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: It will be the owner's responsibility to contract for special inspections to conduct special tests and inspections required by authorities having jurisdiction as follows:
1. Verifying manufacturer's certification by submittal of documentation.
2. Notifying Architect, Owner and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Owner, with copy to Contractor and to authorities having jurisdiction.
4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Retesting and reinspecting corrected work.
6. Submitting a final report of special tests and inspections at Substantial Completion, which shall include descriptions of satisfactory resolutions achieved for all previously reported deficiencies.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

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

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
   2. Protect construction exposed by or for quality-control service activities.
   3. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 4000

SECTION 01 4200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

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

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

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

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

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

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

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

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

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

1.3 INDUSTRY STANDARDS

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

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

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

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

1.4 ABBREVIATIONS AND ACRONYMS

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

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean recognized entities.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean recognized entities.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean recognized names of the standards and regulations.

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean recognized entities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 4200

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:
1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.

1.3 DEFINITIONS

A. Adequate ventilation: Ventilation, including air circulation and air changes required to cure materials, dissipate humidity, and prevent accumulation of dust, fumes, vapors, or gases.

B. Environmental pollution and damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.

C. Hazardous materials: Includes pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).

D. Interior final finishes: Materials and products, that will be exposed at interior, occupied spaces including flooring, wallcovering, finish carpentry, and ceilings.

E. Packaged dry products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging including carpets, resilient flooring, ceiling tiles, and insulation.

F. Wet products: Materials and products installed in wet form including paints, sealants, adhesives, and special coatings.

1.4 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities and utilities shall be included in the Contract Sum unless otherwise indicated.

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

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

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

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

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

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

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. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Provide and maintain temporary water service for drinking and construction purposes for all parts of the Work. Provide potable water approved by local health authorities.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
1. Toilets: Use of Owner's existing toilet facilities is prohibited.

D. 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.

E. 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.

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

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

H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel.
   1. Provide a dedicated telephone line for each facsimile machine in each field office:
   2. Provide superintendent with cellular telephone for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

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

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.

C. Parking: Owner's existing parking area as identified is not allowed for construction personnel.

D. Project Signs: Provide temporary signage as detailed in special conditions. Install at location approved by Owner and Architect and maintain until Final Completion.
   1. Maintain and touchup sign so they are legible at all times.

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

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
   1. Comply with work restrictions specified in Division 01 Section "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings , requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.

2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

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

E. Tree and Plant Protection: Comply with requirements specified in Division 01 Section "Temporary Tree and Plant Protection."

F. Site Enclosure Fence: Before construction operations begin, furnish and install 6' tall chain link site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations or as indicated.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

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

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

I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

3.5 MOISTURE AND MOLD CONTROL

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

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
   1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
   2. Keep interior spaces reasonably clean and protected from water damage.
   3. Periodically collect and remove waste containing cellulose or other organic matter.
   4. Discard or replace water-damaged material.
   5. Do not install material that is wet.
   6. Discard, replace, or clean stored or installed material that begins to grow mold.
   7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
   1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   2. Use permanent HVAC system to control humidity.
   3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

E. Indoor Air Quality:
   1. Interior final finishes: Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.
   2. Temporary ventilation: As specified in this Section, and as follows:
      a. Provide adequate ventilation during and after installation of interior wet products and interior final finishes.
      b. Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degrees F maximum continuously during the ventilation period. Do not ventilate within limits of Work unless othersie approved by the Owner.
   3. Pre-occupancy ventilation: After final completion and prior to initial occupancy, provide adequate ventilation for a minimum of 5 days. Pre-occupancy ventilation procedures:
      a. Use supply air fans and ducts only;
      b. Temporarily seal exhaust ducts;
      c. Temporarily disable exhaust fans;
      d. Provide exhaust through operable windows or temporary openings;
      e. Provide temporary exhaust fans as required to pull exhaust from deep interior locations. Stair towers may be used for exhausting air from the building during temporary ventilation.
      f. After pre-occupancy ventilation and prior to final testing and balancing of HVAC system, replace air filters and make HVAC system fully operational.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal. Mow & trim grass within construction area – not to exceed 2 ½"
   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.

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

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

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

END OF SECTION 01 5000

SECTION 01 5639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction. Refer to tree protection notes and details that are shown on the Demolition Plan drawing.

B. Related Sections:
1. Division 01 Section "Temporary Facilities and Controls" for temporary site fencing.
2. Division 31 Section "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

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

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

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

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

1.4 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
Foot traffic.
Erection of sheds or structures.
Impoundment of water.
Excavation or other digging unless otherwise indicated.
3. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
   1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.
   2. Stockpiled topsoil stripped from the building site may be used.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 TREE- AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area.

B. Maintain protection zones free of weeds and trash.

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

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

3.4 EXCAVATION

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

3.5 REGRADING

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

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

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

3.6 REPAIR AND REPLACEMENT

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

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION 01 5639

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:
1. Division 01 Section "Alternates" for products selected under an alternate.
2. Division 01 Section "Substitution Procedures" for requests for substitutions.
3. Division 01 Section "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

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

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

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

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

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with the specification requirements to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
   1. Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.

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

2.2 EQUAL PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's substitution request for equal product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 7300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.
   9. Correction of the Work.

B. Related Requirements:
   1. Division 01 Section "Summary" for limits on use of Project site.
   2. Division 01 Section "Submittal Procedures" for submitting surveys.
   3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
   4. Division 02 Section "Selective Structure Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

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

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

1.4 QUALITY ASSURANCE

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

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

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

3.2 PREPARATION

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

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a Request for Interpretation to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

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

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Notify Architect when deviations from required lines and levels exceed allowable tolerances.

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

D. Swimming Pool and 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. Provide certified elevation certificate to architect & owner confirming that structures, building floor elevations match design elevations, prior to pouring concrete.

3.4 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.

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

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

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

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

F. 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. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

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

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

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

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

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

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

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

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris, mow and trim sod within project fence.

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.

3.7 OWNER-INSTALLED PRODUCTS

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

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
   1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
   2. Pre-installation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

END OF SECTION 01 7300

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
   1. Division 02 Section "Selective Structure Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
   2. Division 04 Section "Unit Masonry" for disposal requirements for masonry waste.
   3. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

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

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

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

D. 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 QUALITY ASSURANCE

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with operation, termination, and removal requirements in Division 01 Section "Temporary Facilities and Controls."

B. 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. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 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.

B. Burning: Do not burn waste materials.

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

END OF SECTION 01 7419

SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.

B. Related Requirements:
   1. Division 01 Section "Execution" for progress cleaning of Project site.
   2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   4. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
   5. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 DEFININTIONS

A. Substantial completion is the stage in the progress of Work when the Work or designated portion therof is sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work for its intended use.
   1. Work will not be considered for Substantial Completion until all systems and equipment are operational; all designated or required governing agency inspections and certifications have been made and posted, including the Certificate of Occupancy; instruction of designated Owner's personnel in operation of systems and equipment has been completed; operation and maintenance data has been satisfactorily turned over to Owner; and finishes are in place. In general, the only remaining portion of Work shall be minor in nature, such that Owner may occupy or utilize Work or designated portion thereof, and completion or correction of Work by Contractor would not materially interfere or hamper Owner's intended business use or operation.
   2. Contractor shall certify that all remaining Work will be completed within 30 consecutive calendar days following date identified Substantial Completion, or as agreed to in writing, and failure to do so shall automatically reinstate provisions for damages due Owner as contained elsewhere in Contractor to fully complete Work whether Owner has occupied Work or not.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list).

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 calendar days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
   3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
      a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
   5. Submit test/adjust/balance records.
   6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 calendar days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Advise Owner of pending insurance changeover requirements.
   2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   3. Complete startup and testing of systems and equipment.
   4. Perform preventive maintenance on equipment used prior to Substantial Completion.
   5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
   6. Advise Owner of changeover in heat and other utilities.
   7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
   8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   9. Complete final cleaning requirements, including touchup painting.
   10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 calendar days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Owner & Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.5 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures" and as set forth in the General Conditions, Paragraph GC-29.
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 calendar days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Owner & Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Contractor.
   e. Page number.
4. Submit list of incomplete items in the following format:
   a. PDF electronic file.

1.7 SUBMITTAL OF PROJECT WARRANTIES

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

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark 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 Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit removing all tape, stickers, dirt, dust, stains and smears. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep and power wash paved areas. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   g. Sweep and wet mop concrete floors in unoccupied spaces.
   h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
   i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
   j. Remove labels that are not permanent.
   k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
p. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

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

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 7700

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

B. Related Requirements:
   1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. One paper copy and in PDF format on three DVD's. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual to Owner prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Construction Manager.
   7. Name and contact information for Architect.
   8. Name and contact information for Commissioning Authority.
   9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
   10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
   1. Binders: Heavy-duty, three-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," Indicate project title on the binder spine and cover. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. 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 storage media for computerized electronic equipment.
   4. 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.

2.2 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.

5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

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

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

2.3 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

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

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

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

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

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

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

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

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Requirements:
   1. Division 01 Section "Execution" for final property survey.
   2. Division 01 Section "Closeout Procedures" for general closeout procedures.
   3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   4. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set of marked-up record prints and PDF format on three DVD's. To be submitted with O&M manuals.

B. Record Specifications: Comply with the following:
   1. Number of Copies: Submit one paper copy of Project's Specifications, including addenda and contract modifications, and PDF format on three DVD's.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Significant 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.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

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

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. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
2. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

B. Format: Submit record Specifications as paper copy and PDF format.

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. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

B. Format: Submit record Product Data as paper copy and PDF format.
1. Include record Product Data directory organized by Specification Section number and title.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 7839

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Provision of a digital video disc (DVD) for subsequent reference training of each system, subsystem, and piece of equipment demonstrated to the Owner.

B. Related Requirements:
   1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate dates, times, length of instruction time, and course content with Owner's designated representatives.

C. Coordinate content of training with content of approved emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 INSTRUCTION

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Provide a learning objective and teaching outline for Owner training. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.

c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Identification systems.
   e. Warranties and bonds.
   f. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.

e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."

B. Record Owner instruction and training session and prepare DVD including each training module provided to the Owner.

3.2 INSTRUCTION AND TRAINING

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

B. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

END OF SECTION 01 7900

SECTION 02 4119 - SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference(s): Contractor shall organize and conduct conference(s) at Project site with appropriate subcontractors at appropriate stages or phases of demolition. Owner and Architect to be present as required.

1.4 SUBMITTALS

A. Schedule of Selective Demolition activities indicating the following:
1. Detailed sequence of selective demolition work with start and end dates for each activity. Ensure that Owner's on-site operations are uninterrupted.
2. Indicate if and how long utility services will be disrupted.
3. Coordination for shut off, capping and continuation of utility services.
4. Locations of proposed dust and noise control temporary partitions and means of egress.
5. Use of existing elevator(s) and stairs.
6. Coordination of Owner's continuing occupancy of portions of the existing building and of Owner's partial occupancy of completed work.
7. Means of protection for items to remain and items in path of waste removal from building.

B. Predemolition Photographs or Video: Record preexisting conditions of adjoining construction and site improvements including finish surfaces, Submit before Work begins.
1. Comply with requirements specified in Division 01 Section "Photographic Documentation."

C. After demolition is complete, submit a list of items that have been removed or salvaged.

1.5 QUALITY ASSURANCE

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

1.6 FIELD CONDITIONS

A. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with demolition.

B. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

C. Storage or sale of removed items or materials on-site is not permitted.

D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
   1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Arrange to shut off indicated utilities with utility companies.
   2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
      a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      b. Equipment to Be Removed: Disconnect and cap services and remove equipment.
      c. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
      d. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
      e. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   5. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."

B. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Store items in a secure area until delivery to Owner.
   3. Transport items to Owner's storage area designated by Owner.
   4. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:
   1. Clean removed items to be reinstalled.
   2. Store items in a secure area until they are reinstalled.
   3. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 4119

SECTION 03 3300

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. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Elevated slabs.
   5. Concrete toppings.

B. Related Sections include the following:
   1. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

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

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 Architect

E. Samples: For waterstops and vapor retarder.

F. Qualification Data: For installer, manufacturer and testing agency.

G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

H. 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. Fiber reinforcement.
   6. Waterstops.
   7. Curing compounds.
   8. Floor and slab treatments.
   9. Bonding agents.
   10. Adhesives.
   11. Vapor retarders.
   12. Semi-rigid joint filler.
   13. Joint-filler strips.
   14. Repair materials.

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

J. Field quality-control test and inspection reports.

K. Minutes of pre-installation conference.

1.5 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, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 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.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Owner will engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.
   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, and concrete protection.

1.6 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
   a. High-density overlay, Class 1 or better.
   b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
   c. Structural 1, B-B or better; mill oiled and edge sealed.
   d. B-B (Concrete Form), Class 1 or better; mill oiled 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. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

G. Form-Release Agent: Commercially formulated form-release agent containing VOC's less than 250 grams per liter that will not bond with stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch 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, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.4 REINFORCEMENT ACCESSORIES

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

B. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

C. 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.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I/II gray. Supplement with the following:
a. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 3M 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: 1-1/2 inch nominal for foundations, stem walls and slabs on grade; 1 inch nominal for elevated slabs.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C330, ¾-inch nominal maximum aggregate size.

D. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.7 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
   1. Available Products:
      a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
      b. Concrete Sealants Inc.; Conseal CS-231.
      c. Greenstreak; Swellstop.
      d. Henry Company, Sealants Division; Hydro-Flex.
      e. JP Specialties, Inc.; Earthshield Type 20.
      f. Progress Unlimited, Inc.; Superstop.
      g. TCMiraDRI; Mirastop.

2.8 VAPOR BARRIERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A vapor retarder with minimum WVTR of 0.008 as tested by ASTM E96 and permeance as tested after mandatory conditioning (ASTM E 154 sections 8,11,12,13) less than 0.01 Perms. Include manufacturer's recommended adhesive or pressure-sensitive tape (minimum width of tape shall be 4 inches). Construct pipe boots from vapor retarder material and pressure sensitive tape per manufacturer's recommendations.
   1. Available Products:
      a. Stego Wrap (15 mil) Vapor Barrier by Stego Industries
      b. Ecoshield-E (15 mil) Epro
      c. Iron Barr (15 mil) Flatiron Films

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.9 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.10 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces. Apply only to areas scheduled for 'sealed concrete' floor finish. Refer to drawings for location. Protect slab from discoloration prior to applying floor treatment. Clean slab as recommended by floor treatment manufacturer if necessary prior to floor treatment application.
   1. Products:
      a. ChemMasters; Chemsil Plus.
      b. ChemTec International; ChemTec One.
      c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
      d. Curecrete Distribution Inc.; Ashford Formula.

e. Dayton Superior Corporation; Day-Chem Sure Hard.
f. Euclid Chemical Company (The); Euco Diamond Hard.
g. Kaufman Products, Inc.; SureHard.
h. L&M Construction Chemicals, Inc.; Seal Hard.
i. SpecChem; SpecHard.

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.13 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.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 20 percent.
   2. Combined Fly Ash and Pozzolan: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. 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, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

E. Use of Early High Strength Concrete is not approved for this project.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture for Footings and Piers as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days or as shown on drawings.
   2. Maximum Water-Cementitious Materials Ratio: 0.57.
   3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
   4. Slump Limit: 6 inches, plus or minus 1 inch.
   5. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

B. Proportion normal-weight concrete mixture for Slabs-on-Grade as follows:
   1. Minimum Compressive Strength: 3500 psi at 28 days or as shown on drawings.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.
   3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
   4. Slump Limit: 4 inches, plus or minus 1 inch.
   5. Air Content: Do not allow air content of troweled finished slabs to exceed 3 percent.

C. Proportion normal-weight concrete mixture for walls as follows:
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.45
   3. Minimum Cementitious Materials Content: 564 lb/cu. yd.
   4. Slump Limit: 4 inches, plus or minus 1 inch.
   5. Air Content: Do not allow air content of walls to exceed 3 percent.

2.15 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

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

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, 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.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate 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.

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 ITEMS

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. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.

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 for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports 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 will not be 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 Architect.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would 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.
   1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

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

3.5 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 Architect.
   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 into concrete.
   3. Locate joints for beams, slabs, joists, and girders 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 floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: See drawings for locations. Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 WATERSTOPS

A. Self-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.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer of Record.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be 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 to not 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.
   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 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.

E. 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.

F. 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 for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   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.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90 deg F 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.

H. After a rain event, the contractor must delay concrete placement for slabs on grade until the subgrade is dry. The contractor may use commercial air blowers to remove accumulated water.

3.8 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 or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

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.
   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

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.

3.9 FINISHING FLOORS AND SLABS

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

B. 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 in 1 direction.
   1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings or to receive mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

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

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten 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 indicated and to floor and slab surfaces to be exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155 for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
      b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
      c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.11 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 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 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 the remainder of the 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 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 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.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
   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. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least **six** months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 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 in any dimension in solid concrete, but not less than 1 inch in depth. 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 will match 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 Architect.

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, pop-outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch 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 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 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 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 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. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections, sample materials and prepare test reports.

B. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs, hooked anchor bolts and other embedded steel anchors
4. Monitor addition of water to concrete at job site and length of time concrete is allowed to remain in truck during pour.
5. Certify each delivery ticket indicating class of concrete delivered (or poured), amount of water added and time at which cement and aggregate were discharged into truck, and time at which concrete was discharged from truck.
6. Verification of use of required design mixture.
7. Concrete placement, including conveying and depositing.
8. Curing procedures and maintenance of curing temperature.
9. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Contractors Responsibilities:
1. Furnish necessary labor to assist testing agency in obtaining and handling samples at job-site.
2. Advise testing agency in advance of operations to allow for assignment of testing personnel and testing.
3. Provide and maintain for use of testing agency adequate facilities for proper curing of concrete test specimens on project site in accordance with ASTM C31

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. but less than 25 cu. yd. plus one set for each additional 50 cu. yd. or fraction thereof.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/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, 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 and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
7. 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. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. 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.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. 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
10. Test results shall be reported in writing to Architect, 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.
11. Concrete for which strength tests do not meet criteria for acceptance shall be considered inadequate until proven otherwise.
12. Completed concrete work will be accepted when the requirements of ACI 301, Chapter 18 have been complied with.
13. In any case, where strength tests of concrete fail to meet criteria specified herein, Architect shall be sole judge of structural adequacy of concrete. In such case, burden of proof of structural adequacy shall be responsibility of Contractor. Strength evaluation shall conform to requirements of ACI 318. If strength evaluation testing indicates, in opinion of Architect, that structure is of inadequate strength; portions of structure in question shall be repaired or removed and replaced as directed by Architect at no additional expense to Owner. If strength tests fall below specified strength, but not so low as to cause concern for structural adequacy, Architect may request improved conditions of curing or modification of design mixes to improve strength.
14. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
15. 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 Architect. 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 Architect.

16. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
17. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION

SECTION 04 2200

CONCRETE UNIT MASONRY

PART 1 - **GENERAL**

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Embedded flashing.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing and inspecting agency to perform tests and inspections as noted below along with inspection schedule items included in the Contract Drawings. Testing agency shall prepare tests and inspection reports and submit to Owner and Owner's Consultants. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
   1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
   2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
   3. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
   4. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Submit an elevation drawing of each reinforced CMU wall that shows:
      a. Reinforcing bar size, quantity, spacing, length and grade of steel.
      b. Horizontal and vertical locations of all bearing plates and embed plates.
      c. Location of each control joint.

d. Horizontal and vertical location of all embedded anchors.
e. Location and length of lap splices.

3. Submit details showing proper location of reinforcing bars (vertical and horizontal), bearing plates, embed plates and anchor bolts.
4. Include masonry notes that concern construction means and methods, grouting procedures, and proper alignment of reinforcing bars (vertical and horizontal), bearing plates, embed plates and anchor bolts.
5. Prepare shop drawings in accordance with ACI 315. Do not use reproductions of Contract Drawings as shop drawings.
6. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:
1. Colored mortar.
2. Weep holes/vents.
3. CMU color samples.

D. Samples for Verification: For each type and color of the following:

1. Exposed CMUs.
2. Colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellant used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.

    a. Include a sealant-filled joint at least 16 inches long in mockup.
    b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
    c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).

2. Protect accepted mockups from the elements with weather-resistant membrane.
3. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

C. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg Fand higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - **PRODUCTS**

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

A. Regional Materials: CMUs shall be manufactured within 50 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 50 miles of Project site.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as specified on Contract Drawings.
2. Density Classification: Normal weight unless otherwise indicated on Contract Drawings.
3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.5 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.

C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 03 3000 "Cast-in-Place Concrete," and with reinforcing bars indicated.

D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 150 miles of Project site.

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: ASTM C 91.

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. Capital Materials Corporation; Flamingo Color Masonry Cement.
b. Cemex S.A.B. de C.V.; Brikset Type N, Citadel Type S, Dixie Type S, Kosmortar Type N, Richmortar, Victor Plastic Cement.
c. Essroc, Italcementi Group; Brixment or Velvet.
d. Holcim (US) Inc.; Mortamix Masonry Cement, Rainbow Mortamix Custom Buff Masonry Cement, White Mortamix Masonry Cement.

e. Lafarge North America Inc.; Magnolia Masonry Cement, Lafarge Masonry Cement, Trinity White Masonry Cement.
f. Lehigh Cement Company; Lehigh Masonry Cement, Lehigh White Masonry Cement.
g. National Cement Company, Inc.; Coosa Masonry Cement.

F. Mortar Cement: ASTM C 1329/C 1329M.

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. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.

G. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C 404.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

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. Euclid Chemical Company (The); Accelguard 80.
b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

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. ACM Chemistries; RainBloc for Mortar.
b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

K. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inchsteel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
   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, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
      b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
      c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
      d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951.

   1. Interior Walls: Hot-dip galvanized carbon steel.
   2. Exterior Walls: Hot-dip galvanized carbon or stainless steel.
   3. Wire Size for Side Rods: 0.148-inchdiameter.
   4. Wire Size for Cross Rods: 0.148-inchdiameter.
   5. Spacing of Cross Rods: Not more than 16 incheso.c.
   6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.8 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed steel bolts complying with F1554, Grade 55 weldable, with ASTM A 563hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime or mortar cement mortar unless otherwise indicated on Contract Drawings.
   3. For exterior masonry, use portland cement-lime or mortar cement mortar.
   4. For reinforced masonry, use portland cement-lime or mortar cement mortar.
   5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated on Contract Drawings.
1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S.
4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
5. For interior non-load-bearing partitions, Type S.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inchesas measured according to ASTM C 143.

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. Use full-size units without cutting if possible, use no less than ½ unit. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Do not use less-than-half-size units, particularly at corners, jambs, and at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated on contract drawings, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inchhorizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive

mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inchclearance between end of anchor rod and end of tube. Space anchors 48 incheso.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Wet joint surfaces thoroughly before applying mortar.
3. Rake out mortar joints for pointing with sealant.

D. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inchand point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
   1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated on Contract Drawings. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

   1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.
   3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
   4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

A. Provide concrete or masonry lintels where shown and where openings of more than 12 inchesfor brick-size units and 24 inchesfor block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inchesat each jamb unless otherwise indicated.

3.10 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels, extend flashing a minimum of 6 inchesinto masonry at each end. At heads and sills, extend flashing 6 inchesat ends and turn up not less than 2 inchesto form end dams.
3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inchesor as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inchback from outside face of wall, and adhere flexible flashing to top of metal drip edge.
6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inchback from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Unless an alternate procedure is approved by the Engineer of Record, the low-lift grouting procedure as noted in the following shall be used in the construction of reinforced unit masonry.
   a. Units may be laid to a height not to exceed eight feet. If the height exceeds five feet, cleanouts must be used.
   b. Place vertical steel in cells with enough steel extending to provide proper lap splice.
   c. Grout cells in five feet high maximum lifts.
   d. Stop grout 2" below top of masonry when grout is to be stopped for 1 hour or more. All horizontal steel shall be fully embedded in grout.
   e. Consolidate pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.
   f. The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B or C in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.13 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot.Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste.
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 2200

SECTION 04 2300 - GLASS UNIT MASONRY

PART 1 GENERAL

2.01 **SECTION INCLUDES**

A. Glass masonry units.

2.02 **RELATED REQUIREMENTS**

A. Section 079200 - Joint Sealants: Sealing joints between glass unit masonry and adjacent construction.

2.03 **REFERENCE STANDARDS**

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.
B. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019.
C. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.

2.04 **SUBMITTALS**

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for glass units and accessories.
C. Samples: Submit two glass units and two curved units illustrating color, design, and face pattern.

2.05 **MOCK-UP**

A. Mock-up may remain as part of the Work.

2.06 **DELIVERY, STORAGE, AND HANDLING**

A. Accept glass units on site on pallets; inspect for damage.

2.07 **FIELD CONDITIONS**

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.
B. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
C. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

3.01 **MANUFACTURERS**

A. Glass Units:
    1. Basis of design: Stark Glass Block, starkglassblock.com
        a. Type GB-1: Nubio Glass Block
            1) Color: Blue
            2) Size: As indicated on drawings
        b. Type GB-2: Weck – Artic
            1) Color: Clear/Frosted
            2) Size: As indicated on drawings
    2. Substitutions: See Section 016000 - Product Requirements.

3.02 **MORTAR AND POINTING MATERIAL**

A. Mortar: ASTM C270, Type M using the Proportion specification as specified in Section 040511.

B. Stain Resistant Pointing Mortar: One part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 percent of Portland cement by weight.

C. Pointing Sealant: Elastomeric; suitable for contact with mortar.
   1. In Wet Areas: Mildew-resistant silicone sealant.
   2. Exterior Exposure: Polyurethane sealant.

D. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

4.01 **EXAMINATION**

A. Verify that openings are ready to receive work.

4.02 **PREPARATION**

A. Clean glass units of substances that may impair bond with mortar or sealant.

B. Establish and protect lines, levels, and coursing.

C. Protect elements surrounding the work of this section from damage and disfigurement.

4.03 **INSTALLATION**

A. Erect glass units and accessories in accordance with manufacturer's instructions.

B. Locate and secure perimeter metal channel.

C. Coat sill under units with asphalt emulsion as a bond breaker, and allow to dry.

D. Set panel anchors in mortar bed directly over coating.

E. Provide full mortar joints. Furrowing is not permitted. Remove excess mortar.

F. Maintain uniform joint width of 1/4 inch.

G. Place panel reinforcement at every second horizontal joint in full mortar bed and at first course above and below openings within the glass unit panel.

H. Lap reinforcement joints 6 inches. Discontinue reinforcement at expansion joints.

I. Isolate panel from adjacent construction on sides and top with expansion strips concealed within perimeter trim. Keep expansion joint voids clear of mortar.

J. Shore assembly until setting bed will maintain panel in position without movement.

4.04 **TOLERANCES**

A. Variation From Joint Width: Plus 1/8 inch and minus 0 inches

B. Maximum Variation from Plane of Unit to Adjacent Unit: 1/32 inch.

C. Maximum Variation of Panel from Plane: 1/8 inch.

4.05 **CLEANING**

A. Clean and polish faces of glass unit masonry, using materials and technique that will not scratch or deface units.

4.06 **PROTECTION**

A. Maintain protective boards at exposed external corners. Provide protection without damaging completed work.

END OF SECTION

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes structural steel and grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 PERFORMANCE REQUIREMENTS

A. Connections: Fabricator to design connections not designed or fully detailed on Contract Documents. Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Load and Resistance Factor Design," Volume 2, Part 9 or AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4.
2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

1.4 SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.

C. Qualification Data: For Installer, fabricator and testing agency.

D. Welding certificates.

E. Mill test reports for structural steel, including chemical and physical properties.

F. Source quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Not less than 10 years of experience in erection of structural steel for projects of similar size and complexity.

B. Fabricator Qualifications: Not less than 10 years of experience in erection of structural steel for projects of similar size and complexity.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders are to be employed on work shall maintain current AWS certification throughout duration of project.
2. If requested by Architect, submit identifying stenciled test coupons made by operator whose workmanship is subject to question, and if reasonable doubt of proficiency exists, welder shall be re-qualified and certified by independent testing laboratory at no additional expense to Owner.
3. Work suspected of deficient quality may be subject to removal of coupons from any location on any joint for testing. Remove section of welds found defective and properly re-weld before proceeding with work

D. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
4. AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings".
5. AISC's "Specification for the Design of Steel Hollow Structural Sections."
6. AISC's "Specification for Allowable Stress Design of Single-Angle Members".
7. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members".
8. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication

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 anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M (Grade 50).

B. Channels and Angles: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: Unless noted otherwise on Contract Documents, ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers. Plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

E. Un-headed Anchor Rods: ASTM F 1554, Grade as indicated on Contract Document.

F. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Plain unless noted otherwise on the Contract Documents.

G. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Washers: ASTM F 436 hardened carbon steel.
3. Finish: Plain unless noted otherwise on the Contract Documents.

H. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

I. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

A. Low-Emitting Materials: Paints and coatings 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".

B. Comply with Section 099123 "Interior Painting". All interior structural steel shall receive a factory applied primer coat compatible with the finish paint

C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

F. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" or "Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   c. Ultrasonic Inspection: ASTM E 164.
   d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections

D. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

END OF SECTION

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Miscellaneous steel trim.
2. Steel framing and supports for countertops.
3. Metal Ladders
4. Monorail in Pool Equipment.

1.2 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
a. 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.

1.3 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Provide allowance for trimming and fitting at site.

1.4 COORDINATION

A. Coordinate installation of anchorage for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleevs, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in cioncrete or masonry. Deliver such items to Project Site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for Work of another Section. Deliver such items to Project Site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast curing, lead- and chromate-free, universal modified-alkyd primer complying with Division 09 Painting section.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Cap ends of tube steel countertop supports unless otherwise indicated.

2.7 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3 unless otherwise indicated.
   2. For elevator pit ladders, comply with ASME A17.1.

B. Steel Ladders:
   1. Space siderails of ladders 18 inches apart unless otherwise indicated.
   2. Provide nonslip abrasive surfaces on top of each rung.
   3. Galvanize exterior ladders, including brackets and fasteners.
   4. Prime ladders, including brackets and fasteners, with primer specified in Division 09 Painting section.
   5. Comply with OSHA standards.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.9 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer specified in Division 09 Painting section.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 5000

SECTION 05 5213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel pipe tube railings.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
      b. Infill load and other loads need not be assumed to act concurrently.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer's product lines of mechanically connected railings.
   2. Railing brackets.
   3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.2 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed).

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

E. Expanded Metal: ASTM F 1267, Type I (expanded), Class 1 (uncoated).
1. Style Designation: 3/4 number 13

F. Woven-Wire Mesh: Intermediate-crimp, diamond square pattern, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A 510.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Provide the following:
1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

C. Etching Cleaner for Galvanized Metal: Complying with Division 09 Painting sections.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Shop Primers: Provide primers that comply with Division 09 Painting sections.

F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

G. Shop Primer for Galvanized Steel: Water based galvanized metal primer complying with Division 09 Painting sections..

H. Epoxy Intermediate Coat: Complying with Division 09 Painting sections and compatible with primer and topcoat.

I. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

J. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.4 STEEL AND IRON FINISHES

A. Galvanized Railings:
   1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
   2. Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
   3. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
   4. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Do not apply primer to galvanized surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
   1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

C. Anchor posts in concrete by inserting into preset metal pipe sleeves and grouting annular space.

D. Anchor posts to metal surfaces with oval flanges unless otherwise indicated.

E. Attach railings to wall with wall brackets, except where end flanges are used. Use type of bracket with predrilled hole for exposed bolt anchorage unless otherwise indicated.

F. Secure wall brackets and railing end flanges to building construction as follows:
   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 5213

SECTION 06 1000
ROUGH CARPENTRY

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

A. Section Includes:

1. Framing with dimension lumber.
2. Shear wall panels.
3. Wood blocking, cants, and nailers.
4. Wood furring.
5. Wood sleepers.

1.03 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. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.05 INFORMATIONAL SUBMITTALS

A. 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.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Powder-actuated fasteners.
7. Expansion anchors.
8. Metal framing anchors.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

A. indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. 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.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
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 that 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.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: As indicated on Construction Drawings.

B. Load-Bearing Partitions: As indicated on Construction Drawings.

C. Joists, Rafters, and Other Framing Not Listed Above: As indicated on Construction Drawings

2.04 SHEAR WALL PANELS

A. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.

2.05 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Cants.
4. Furring.
5. Grounds.
6. Utility shelving.

B. For items of dimension lumber size, provide No. 2 grade lumber and any of the following species:

C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.06 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.

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.

2.07 METAL FRAMING ANCHORS

A. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

2.08 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; 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 manufacture

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.

PART 3 - EXECUTION

3.01 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 WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Shear Wall Panels: Install shear wall panels to comply with manufacturer's written instructions.

D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

F. Do not splice structural members between supports unless otherwise indicated.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal-thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

I. 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.

J. 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.

K. Securely attach rough carpentry work to substrate by anchoring and 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 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.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.02 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.03 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

3.04 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide 2-by-4-inch nominal-size wood studs spaced 16 inches o.c. unless otherwise indicated.

2. For interior partitions and walls, provide 2-by-4-inch nominal-size wood studs spaced 16 inches o.c. unless otherwise indicated.
3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.

3.05 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1000

SECTION 06 1600

SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Composite nail base insulated roof sheathing.
4. Subflooring.
5. Underlayment.
6. Sheathing joint and penetration treatment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving 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.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-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.

2.2 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet 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."

B. Plywood: DOC PS 1.

C. Oriented Strand Board: DOC PS 2.

D. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

E. Factory mark panels to indicate compliance with applicable standard.

2.3 WALL SHEATHING

A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 24/0.
2. Nominal Thickness: As indicated.

B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 24/0.
2. Nominal Thickness: As indicated.

2.4 ROOF SHEATHING

A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 48/24.
2. Nominal Thickness: As indicated.

B. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 48/24.
2. Nominal Thickness: As indicated.

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 roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153.

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 and roof 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 to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
1. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

G. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

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 and roof 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. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:

a. Nail to wood framing.
b. Screw to cold-formed metal framing.
c. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 06 1600

SECTION 06 1753

SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood roof trusses.
2. Wood truss bracing.

1.2 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For wood-preservative-treated lumber, fire-retardant-treated lumber, metal-plate connectors, metal truss accessories, and fasteners.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer registered in the state of Oklahoma responsible for their preparation.

1. Approved shop drawings and calculations signed and sealed by a structural engineer licensed in the state of Oklahoma will be provided to the owner for deferred submittal for permit.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates

B. Evaluation Reports: For the following, from ICC-ES:
   1. Metal-plate connectors.
   2. Metal truss accessories.

1.5 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

   1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
   2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction and is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design metal-plate-connected wood trusses.

B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

   1. Design Loads: As indicated.
   2. Maximum Deflection Under Design Loads:

      a. Roof Trusses: Vertical deflection of 1/240 of span.

2.2 DIMENSION LUMBER

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, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Provide dressed lumber, S4S.
4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

B. Minimum Specific Gravity for Top Chords: 0.50.

C. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 10 00 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

A. Source Limitations: Obtain metal connector plates from single manufacturer.

B. General: Fabricate connector plates to comply with TPI 1.

C. Hot-Dip Galvanized-Steel Sheet: ASTM A 653; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

1. Use for interior locations unless otherwise indicated.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153.

B. Nails, Brads, and Staples: ASTM F 1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

A. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

C. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick.

D. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

E. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

2.6 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.7 SOURCE QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.

1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.

B. Correct deficiencies in Work that special inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Section 06 10 00 "Rough Carpentry."

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

L. Replace wood trusses that are damaged or do not meet requirements.

1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION 06 1753

SECTION 07 1700 - BENTONITE WATERPROOFING AND SLAB INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Bentonite waterproofing of walls below grade including equipment pits (walls and pit slab).
2. Exterior perimeter insulation.

1.2 SUBMITTALS

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

B. Material certificates.

C. Product test reports.

D. Sample warranty.

1.3 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer and Installer agree(s) to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to the following:
1. Water penetrating the building or structure.
2. Deteriorated or displaced waterproofing materials.

B. Warranty Period: Five years from date of Final Acceptance.

PART 2 - PRODUCTS

2.1 BENTONITE WATERPROOFING MEMBRANE

A. Standard Waterproofing Membrane: Interlocked geotextiles encapsulating a minimum 1.10-lbs per square foot (5.37 kg/sqm) of granular sodium bentonite. Composite shall consist of one woven and one nonwoven polypropylene geotextile, interlocked using a needle-punching process that produces several interlocks per square inch (6.5 sq cm) over the entire area of the product.
1. Products:
a. CETCO; Voltex.

2.2 INSTALLATION ACCESSORIES

A. General: Manufacturer's standard accessories recommended for intended use and compatible with bentonite waterproofing.

B. Perimeter Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square edged.
1. Type VI, 40-psi minimum compressive strength.
2. Thickness: 2 inches.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Prepare substrates to be waterproofed, install waterproofing and accessories, and protect waterproofing from damage and wetting according to manufacturer's written instructions.

B. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.

C. Install waterproofing and accessories according to manufacturer's written instructions, standard details, and recommended practice.

D. Install wall-to-footing bentonite continuously at base of wall waterproofing (on footing against wall) according to manufacturer's written instructions.

3.2 BENTONITE WATERPROOFING MEMBRANE INSTALLATION

A. SLAB / BACKFILLED WALL FOOTING EDGE TRANSITION COURSE

1. Inside the slab/footing form edge, secure waterproofing sheet horizontally oriented (white geotextile side down; dark gray geotextile side up) to the top inside edge of the exterior slab/footing form with the sheet conforming to the interior form surfaces and then extending out onto the horizontal slab substrate a minimum 12". Overlap edges of adjacent waterproofing sheets a minimum 4" and secure to prevent sheet movement during construction or concrete placement. Retain subparagraph below if substrate is subject to hydrostatic pressure of 33 feet of water column (100 kPa) or more.

B. UNDER SLAB INSTALLATION

1. Install waterproofing under all footings, elevator pits and grade beams when hydrostatic conditions exists or are anticipated per the historical high ground water elevation reported in the project's geotechnical documents.

2. Install waterproofing membrane (white geotextile side down; dark gray geotextile side up) extending to interior edge of footing/slab edge, fully overlapping the 12" horizontal tail of the waterproofing slab edge sheet installed in Section 3.04B. Overlap edges of adjacent waterproofing sheets a minimum 4" and secure to prevent sheet movement during construction or concrete placement.

3. Place waterproofing directly on properly prepared substrate (white geotextile side down; dark gray geotextile side up facing installer) with adjoining edges overlapped a minimum of 4". Stagger sheet end seams a minimum of 24". Mechanically fasten or staple waterproofing as required to prevent movement from construction operations or concrete placement. When the slab is poured in sections, extend waterproofing a minimum 12" beyond the slab edge to enable proper overlapping.

4. Install waterproofing system at all grade beams, pile caps, and other detail areas in accordance with manufacturer's detail for specific project condition(s).

C. BACKFILLED CAST-IN-PLACE CONCRETE WALLS

1. Place Hydrobar Tubes along the wall/footing intersection with ends "butted" tightly together to form a continuous installation.

2. Trowel 3/4" thick, continuous Bentoseal fillet at all inside wall corner transitions. Trowel Bentoseal form-tie pockets/patches and any slightly irregular concrete surface honeycomb areas.

3. Starting at the base of the wall, install waterproofing sheet horizontally (dark gray geotextile side against the wall; white geotextile side facing installer) covering the Hydrobar Tubes and extending onto the footing a minimum of 6". For hydrostatic conditions, cover the entire footing and overlap waterproofing membrane from underslab work a minimum of 6". Attach waterproofing sheet using washer-headed mechanical fasteners maximum 24" on center. Overlap all adjacent sheet edges a minimum 4". Stagger all vertical overlap seams a minimum of 12".

4. After the bottom horizontal course, waterproofing sheets can be installed either vertically or horizontally oriented. Continue waterproofing installation up wall to finished grade elevation detail, staggering all sheet roll ends of adjacent courses a minimum 12". Do not allow horizontal waterproofing overlap joints to run at same elevation as the concrete pour lift joints. Overlap all adjacent waterproofing sheet edges a minimum 4" and secure with washer-head fastener maximum 24" on center.

5. Terminate waterproofing membrane 12" below finished grade elevation secured with washer-head fasteners maximum 12" on center to exterior surface of concrete wall. Per manufacturer's detail for specific project condition(s), install GS-40SA grade flashing to primed concrete substrate with bottom edge overlapping top edge of waterproofing membrane minimum 4". Overlap all roll ends a minimum 4" to form a continuous flashing. Height of flashing shall be per project details and specifications. Install a rigid termination bar along the top edge of GF-40SA; fastened maximum 12" on center. Complete grade termination detail with tooled bead of CETSEAL along the top edge, at all penetrations through the flashing, and all exposed overlap seams.

D. Penetrations: For all pipe, rebar, structural and other penetrations install waterproofing system in accordance with manufacturer's detail for specific project condition(s).

E. Inspect finished waterproofing system installation and repair any damaged material prior to slab and backfill placement. Assure that waterproofing system is not displaced during backfill placement or soil compaction.

3.3 INSULATION INSTALLATION

A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
   1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
   1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

END OF SECTION 07 1700

SECTION 07190 - WATER REPELLENTS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes clear water-repellent coatings for the following vertical and nontraffic horizontal surfaces:
   1. Interior Concrete (unpainted).
   2. Concrete unit masonry (unpainted and unglazed).

1.2 PERFORMANCE REQUIREMENTS

A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.
   1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
      a. Concrete Unit Masonry: ASTM C 140.
      b. Hardened Concrete: ASTM C 642.
   2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
   3. Water Penetration and Leakage through Masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.
   4. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 53.
   5. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, per ASTM D 1653.
   6. VOC content: In accordance with applicable rules and regulations.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface to be treated, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.

B. Applicator Certificates: Signed by manufacturer certifying that the applicator complies with requirements.

C. Material Test Reports: Indicate and interpret test results for compliance of water repellents with requirements indicated.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who employs only persons trained and approved by water repellent manufacturer for application of manufacturer's products.

B. Testing Agency Qualifications: An independent testing agency with experience and capability to conduct testing indicated in "Performance Requirements" Article without delaying the Work, per ASTM E 548.

C. Mock Up Samples: Architect will select one representative surface, including joints, for each substrate to receive water repellents. Apply water repellent to each substrate, with either partial or full coverage as directed. Comply with application requirements of this Section.
   1. Obtain Architect's approval of mock-ups before applying water repellents.
   2. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.

1.5 PROJECT CONDITIONS

A. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of manufacturer:
   1. Ambient temperature is less than 40 deg F (4.4 deg C).
   2. Concrete surfaces and mortar have cured for less than 28 days.
   3. Rain or temperatures below 40 deg F (4.4 deg C) are predicted within 24 hours.
   4. Application is earlier than 24 hours after surfaces have been wet.
   5. Substrate is frozen or surface temperature is less than 40 deg F (4.4 deg C).
   6. Windy condition exists that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.

1.6 WARRANTY

A. Warranty: Submit a written warranty, executed by the applicator and water repellent manufacturer, covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the specified warranty period. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch (1.5 mm) wide, fire, vandalism, or abuse by maintenance equipment.
   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Products: Provide the following products for substrates as indicated:
   1. Concrete: Enviroseal 20.
   2. Concrete Masonry Units: Enviroseal PBT.

2.2 WATER REPELLENTS

A. Low-Solids Acrylic: Water-clear, breathing coating of acrylic resins; water-based, solvent-based, or acrylic emulsion solution containing less than 15 percent solids by volume.

PART 3 – EXECUTION

3.1 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's written instructions, to ensure surface is sufficiently dry.
   1. Formed Concrete: Remove oil, curing compounds, laitance, and other substances that could prevent adhesion or penetration of water repellents.

B. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is

the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

C. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
   1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

3.2 APPLICATION

A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized technical service representative to inspect and approve the substrate before application and to instruct the applicator on the product and application method to be used.

3.4 CLEANING

A. Protective Coverings: Remove protective coverings from adjacent surfaces and other protected areas.

B. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

END OF SECTION

SECTION 07 2100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Foam-plastic board insulation.
   2. Glass-fiber blanket insulation.
   3. Vapor retarders.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.

B. Fire Performance Characteristics: Provide insulation with fire performance characteristics indicated per ASTM E 119, ASTM E 84 and E 136, as applicable, and which correspond to products listed in UL "Fire Resistance Directory" or "Building Materials Directory".
   1. Except as otherwise specified or required by code, insulation materials, including facings and components shall have a flame-spread rating not to exceed 25, and a smoke density not to exceed 450.

C. Unless otherwise indicated, provide R-19 insulation at walls and R-30 insulation at roof.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   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. DiversiFoam Products.

b. Dow Chemical Company.
c. Owens Corning.
2. Type X, 15 psi.
3. Thickness: As indicated.

2.2 BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. CertainTeed Corporation.
2. Johns Manville.
3. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Safing insulation: Mineral fiber; UL approved, non-combustible when tested in accordance with ASTM E 84, having flame spread of 15 and smoke development of 0. Provide with Code approved galvanized steel closures, clips, and ties to secure safing insulation and conform to Code.

2.3 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm when tested by ASTM E 96.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

E. Examine areas which receive insulation to insure protection against inclement weather during and after installation.

F. Examine space allocated for insulation for proper depth to receive material. Verify that depth of space available can accommodate thickness of insulation necessary to achieve required R value.

G. Correct unsuitable conditions before proceeding with installation.

3.2 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber or Mineral Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

D. Sill Plate Gasket: Install in accordance with manufacturer's written instructions. Install in longest lengths possible. Coordinate placement with work of other trades. Install at all exterior framed walls.

3.3 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
   1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
   2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
   3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
   4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.4 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
   1. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. 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.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

END OF SECTION 07 2100

SECTION 07 4113 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Standing-seam metal roof panels.
2. Standing-seam metal soffit panels.
3. Standing-seam fascia panels
4. Snow guards

1.2 PERFORMANCE REQUIREMENTS

A. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

B. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: UL 90.

C. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
1. Fire/Windstorm Classification: Class 1A-90.
2. Hail Resistance: SH.

D. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
1. Wind Loads: Determine loads based on the following minimum design wind pressures:
a. Uniform pressure as indicated, acting inward or outward.
2. Snow Loads: As indicated.
3. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than 1/240 of the span.

E. Provide roof panels that are listed on the U.S. Department of Energy's ENERGY STAR Roof Products Qualified Product List for steep-slope roof products.

1.3 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

C. Samples: For each type of exposed finish required.

D. Maintenance data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Fire-Resistance Ratings: Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Combustion Characteristics: ASTM E 136.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Two years from date of Final Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Finish Warranty Period: 20 years from date of Final Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Provide all metal panel systems from a single manufacturer.

B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
2. Surface: Smooth, flat finish.
3. Exposed Coil-Coated Finish: Galvalume Plus/
4. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish.

C. Panel Sealants:
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 FIELD-INSTALLED THERMAL INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. minimum density unless otherwise indicated; with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.

2.3 UNDERLAYMENT MATERIALS

A. Ice and Water Shield: Tamko TW Metal and Tile Underlayment, self-adhering silicone treated release sheet on adhesive side.

2.4 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
   2. Manufacturers: Subject to compliance with requirements, provide Peterson Aluminum Corporation Snap-Clad product or an equal from one of the following :
      a. Architectural Building Components
      b. Berridge Manufacturing Company.
      c. MBCI; a division of NCI Building Systems, L. P.
      d. McElroy Metal, Inc.
   3. Profile: Vertical-rib, snap-joint, as indicated on Drawings.
   4. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch nominal thickness.
      a. Exterior Finish: Galvalume Plus
      b. Color: Color to be selected by Architect from Manufacturer's full range or as indicated on drawings.
   5. Clips: Floating to accommodate thermal movement.
      a. Material: Metallic coated steel.
   6. Joint Type: As standard with manufacturer.
   7. Panel Coverage: 16 inches.
   8. Panel Height: 1 ½ inches to 2 inches

2.6 STANDING-SEAM METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
   2. Manufacturers: Subject to compliance with requirements, provide Peterson Aluminum Corporation Snap-Clad PAC-750 Half Vented Soffit product or an equal from one of the following :

a. Architectural Building Components
b. Berridge Manufacturing Company.
c. MBCI; a division of NCI Building Systems, L. P.
d. McElroy Metal, Inc.

3. Profile: Vertical-rib, snap-joint, as indicated on Drawings.
4. Material: Zinc-coated (galvanized) steel sheet, 0.032-inch nominal thickness.
   a. Exterior Finish: Galvalume Plus
   b. Color: Color to be selected by Architect from Manufacturer's full range or as indicated on drawings.
5. Clips: Floating to accommodate thermal movement.
   a. Material: Metallic coated steel.
6. Joint Type: As standard with manufacturer.
7. Panel Coverage: 12 inches.
8. Panel Height: ½" to 3/8"

2.7 STANDING-SEAM METAL FASCIA PANELS

A. General: Provide factory-formed metal fascia panels designed to be installed by lapping and interconnecting snap edges and mechanically attaching panels to supports using concealed clips or nailers. Include clips, nailers, fasteners cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
2. Manufacturers: Subject to compliance with requirements, provide Peterson Aluminum Corporation PAC Snap Edge Fasica product or an equal from one of the following :
   a. Architectural Building Components
   b. Berridge Manufacturing Company.
   c. MBCI; a division of NCI Building Systems, L. P.
   d. McElroy Metal, Inc.
3. Profile: PAC Snap Edge FA
4. Material: Zinc-coated (galvanized) steel sheet, 24 GA Steel
   a. Exterior Finish: Galvalume Plus
   b. Color: Color to be selected by Architect from Manufacturer's full range or as
5. Joint Type: As standard with manufacturer.
6. Panel Coverage: 12 inches.

2.8 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished

appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

C. Gutters & Downspouts: Refer to Specification Section 07 6200 Sheet Metal Flashing and Trim. Finish to match metal panel systems finish.

E. Snow Guards: ColorGard Snow Retention System by Peterson Aluminum Corporation or an approved equal. Finish: Match Roof panels.

2.9 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Ice and Water Shield Underlayment: Apply at locations indicated on Drawings, in shingle fashion to shed water, and with lapped joints of not less than 2 inches.

B. Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."

3.2 THERMAL INSULATION INSTALLATION

A. Board Insulation: Extend insulation in thickness indicated to cover entire roof. Comply with installation requirements in Division 07 Section "Thermal Insulation."
   1. Erect insulation and hold in place with Z-shaped furring members spaced 24 inches o.c. Securely attach narrow flanges of furring members to roof deck with screws spaced 24 inches o.c.

3.3 METAL ROOF PANEL INSTALLATION

A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
   1. Install clips to supports with self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
   3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   3. Provide elbows at base of downspouts to direct water away from building.
   4. Install snow guards per manufacturer's recommendations at locations indicated.

3.5 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 07 4113

SECTION 074213 - METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

Section Includes:

1. Exposed-fastener, ribbed interlocking metal wall panels.

1.2 PERFORMANCE REQUIREMENTS

Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

Wind Loads: Determine loads based on the following minimum design wind pressures:

Uniform pressure of 30 lb./sq. ft., acting inward or outward.

Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than L/180 of the span.

1.3 ACTION SUBMITTALS

Product Data: For each type of product indicated.

Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.

Samples: For each type of exposed finish required. Samples to illustrate finish color, sheen, profile, and texture.

Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items.

Product test reports.

Warranties: Samples of special warranties.

1.5 QUALITY ASSURANCE

Installer Qualifications: An employer of workers trained and approved by manufacturer.

1.7 WARRANTY

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

Warranty Period: Five years from date of Substantial Completion.

Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.Retain one of first two subparagraphs below. Coordinate with products specified.

Zinc-Coated (Galvanized) Steel Sheet:

ASTM A 653/A 653M, G90 coating designation; structural quality.
Surface: Smooth finish.

Exposed Coil-Coated Finish:

2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.

Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish.

B. Panel Sealants:

Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
Joint Sealant: ASTM C 920 as recommended in writing by metal wall panel manufacturer.
Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Retain any of six paragraphs below as required. Revise to suit Project.

C. Sub girts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch nominal thickness.

D. Zee Clips: 0.079-inch nominal thickness.

E. Base or Sill Angles: 0.079-inch nominal thickness.

F. Hat-Shaped, Rigid Furring Channels:
1. Nominal Thickness: As required to meet performance requirements
2. Depth: As indicated.

2.3 MISCELLANEOUS MATERIALS

Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.4 CONCEALED FASTENENING SYSTEM METAL WALL PANELS

Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners inside laps. Include accessories required for weathertight installation.

1. Basis-of-Design Product: MCBI; Div. of NCI Building Systems, as noted below.
   a. **METAL WALL PANEL SYSTEM**
      i. Profile: Designer Series, 12.0 Flat panel
      ii. Panel Gauge: 22
      iii. Surface: Smooth
      iv. Color: As selected by architect from manufacturer's full range.

2. Berridge HS-12 Panel. Berridge Manufacturing Co.

3. Pac-Clad Flush and Reveal Wall Panels. Pac-Clad Petersen.

2.5 DECORATIVE METAL PANELS

Provide factory-formed metal panels designed to be field assembled.

1. Basis-of-Design Product: Parasoleil.
   b. **DECORATIVE METAL PANEL**
      i. Pattern: Constella
      ii. Material: Aluminum, powder coated
      iii. Size: 3'x5' for panels, 3'x8' for gates.
      iv. Panel Gauge: 22
      v. Surface: Smooth
      vi. Color: As selected by architect from manufacturer's full range.

1. 2.5 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

i. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.

ii. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.018-inch minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

C, Aluminum Extruded Corners: Structurally-bonded horizontal exterior trimless corners matching metal wall panel material, profile, and factory-applied finish, fabricated and finished by metal wall panel manufacturer.

1. Welded, riveted fastened, or field-fabricated corners do not meet the requirements of this specification.

2.6 FABRICATION

General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.

Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and

other characteristics of item indicated.

PART 3 - EXECUTION

3.1 PREPARATION

Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.2 METAL WALL PANEL INSTALLATION

Exposed Fastener Metal Roof Panels: Install weathertight metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal roof panels in orientation, sizes, and locations indicated, free of waves, warps, buckles, fastening stresses, and distortions. Anchor panels and other components securely in place. Provide for thermal and structural movement.

Panel Sealants: Install manufacturer's recommended tape sealant at panel sidelaps and endlaps.

Panel Fastening: Attach panels to supports using screws, fasteners, and sealants recommended by manufacturer and indicated on approved shop drawings.

Fasten metal panels to supports at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.

Provide weatherproof jacks for pipe and conduit penetrating metal panels of types recommended by manufacturer.

Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

3.3 ACCESSORY INSTALLATION

A. General: Install metal panel trim, flashing, and accessories using recommended fasteners and joint sealers, with positive anchorage to building, and with weather tight mounting. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

B. Joint Sealers: Install joint sealers where indicated and where required for weathertight performance of metal panel assemblies, in accordance with manufacturer's written instructions.

1. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.4 CLEANING AND PROTECTION

Remove temporary protective films immediately in accordance with metal panel manufacturer's instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manufactured reglets and counterflashing.
   2. Formed roof drainage sheet metal fabrications.
   3. Formed wall sheet metal fabrications.

1.2 SUBMITTALS

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

B. Shop Drawings: Show installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop and field assembled work.
   1. Include details for forming, joining, supporting, and securing sheet metal flashing and trim, including pattern of seams, termination points, fixed points, expansion joints, expansion-joint covers, edge conditions, special conditions, and connections to adjoining work.

C. Samples: Submit one 12 inch long sample of each metal type for each pre-finished color.

D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.4 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 20 years from date of Final Acceptance.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; finish.

C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
   2. Surface: Mill phosphatized surface where indicated for field painting.

2.2 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
   3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

C. Solder:
   1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
   2. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 REGLETS

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with

factory-mitered and -welded corners and junctions with interlocking counterflashing on exterior face, of same metal as reglet.

1. Material: Galvanized steel, 0.022 inch thick or as indicated.
2. Finish: Match adjacent wall color and gloss with manufacturer's full range of color coating or as indicated.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
2. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

C. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.

1. Accessories: Wire ball downspout strainer.
2. Color: To be selected by architect from manufacturer's full range: 0.022 inch thick.

B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Fabricate from the following materials:
   a. Color: To be selected by architect from manufacturer's full range: 0.022 inch thick.

C. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:

1. To be selected by architect from manufacturer's full range: 0.028 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch long, but not exceeding 12-foot- long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch- high, end dams where flashing is discontinuous. Fabricate from the following materials:
1. Stainless Steel: 0.016 inch thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch high, end dams. Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

2.8 FINISHES

A. Galvanized Steel: High-Performance Organic Coating Finish. Apply the following system by coil-coating process on galvanized steel sheet as recommended by coating manufacturers and applicator.
1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat thermocured system composed of inhibitive primer and fluoropolymer topcoat containing not less than 70 percent polyvinyldene fluoride resin by weight; complying with AAMA 605.2.
2. Color and Gloss: Match adjacent wall color and gloss unless otherwise indicated.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
   1. Coat back side of uncoated stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance .

E. Seal joints as shown and as required for watertight construction.

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
   1. Do not solder metallic-coated steel sheet.
   2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
   3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

G. Rivets: Rivet joints where necessary for strength.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
   1. Install gutter with expansion joints not exceeding 50 feet apart, or as otherwise indicated. Install expansion-joint caps.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
   1. Install concrete splash blocks where downspouts discharge on low-slope roofs and at-grade downspouts unless otherwise indicated.

D. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch below scupper gutter discharge.

E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04 Section "Unit Masonry."

C. Reglets: Installation of reglets is specified in Division 03 Section "Cast-in-Place Concrete" and Division 04 Section "Unit Masonry".

D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 07 6200

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Sealants and caulking of all new exterior and interior joints as indicated and as required to maintain total waterproof integrity of joints.
   2. Acoustical joint sealants.

B. Sealants and caulking of all new exterior and interior joints as indicated and as required to maintain total waterproof integrity of joints.

1.2 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

D. Product test reports.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.4 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: One year from date of Final Acceptance.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Final Acceptance.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Suitability for Immersion in Liquids. Where sealants are indicated for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

B. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.2 SILICONE JOINT SEALANTS

A. Mildew-Resistant Neutral-Curing Silicone Joint Sealant: ASTM C 920.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
      a. BASF Building Systems.
      b. Dow Corning Corporation.
      c. GE Advanced Materials - Silicones.
      d. Pecora Corporation.
      e. Tremco Incorporated.
   2. Type: Single component (S).
   3. Grade: Nonsag (NS).
   4. Class: 25.
   5. Uses Related to Exposure: Nontraffic (NT).

2.3 URETHANE JOINT SEALANTS

A. Urethane Joint Sealant: ASTM C 920.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
      a. BASF Building Systems.
      b. Bostik, Inc.
      c. Pecora Corporation.
      d. Tremco Incorporated.
   2. Type: Multicomponent (M).
   3. Grade: Pourable (P) or Nonsag (NS).
   4. Class: 25.
   5. Uses Related to Exposure: Traffic (T) or Nontraffic (NT).

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

a. BASF Building Systems.
b. Bostik, Inc.
c. Pecora Corporation.
d. Tremco Incorporated.

2.5 PREFORMED JOINT SEALANTS

A. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

2.6 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
      a. Pecora Corporation; AC-20 FTR.
      b. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
      c. USG Corporation; SHEETROCK Acoustical Sealant.
   2. Apply acoustical joint sealants where indicated and as specified in other Division 09 Sections.

2.7 JOINT SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
   1. Remove laitance and form-release agents from concrete.
   2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.3 CURING

A. Cure sealants in accordance with manufacturer's printed instructions to obtain high early bond strength, internal cohesive strength, and durability.

B. If finished sealant has bubbles or other defects, replace sealant and backing.

3.4 PROTECTION AND CLEANING

A. Protect adjacent surfaces against stains, smears, and other damage during the sealant application.

B. Immediately clean and remove droppings, smears, and other soiling caused by sealant application. Use solvents and cleaning agents recommended by sealant manufacturer. Use in accordance with solvent and cleaning agent manufacturer's instructions. Leave no stain, damage, or discoloration on surfaces.

3.5 SCHEDULE

A. Exterior Joints:
   1. Joints in vertical surfaces:
      a. Multicomponent Nonsag Urethane Sealant.
      b. Color: To match adjacent material.
   2. Joints in horizontal surfaces subject to traffic:
      a. Multicomponent Pourable Urethane Sealant.
      b. Color: To match adjacent material.
   3. Joints at glazed openings to be in accordance with recommendation of glazing and frame manufacturer's and as follows:
      a. One-Part Nonacidic Curing Silicone Sealant.

B. Interior Joints:
   1. Joints in vertical surfaces, except in areas exposed to moisture:
      a. Latex Sealant.
      b. Color: To match adjacent material.
   2. Joints in areas exposed to moisture and where plumbing fixtures meet adjacent floor and wall finishes:
      a. Silicone-Emulsion Sealant.
      b. Color: To match adjacent material.
   3. Joints in horizontal surfaces subject to traffic:
      a. Multicomponent Pourable Urethane Sealant.
      b. Color: To match adjacent material.

END OF SECTION 07 9200

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hot dip galvanized standard hollow metal doors and frames.
   2. Fire-rated metal doors and frames.

1.2 SUBMITTALS

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

B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.

C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

D. Test Reports: Certified laboratory reports, performed in accordance with ASTM E90 and ASTM E 413, from independent testing laboratory qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) supporting compliance of assemblies to specified requirements.

1.3 QUALITY ASSURANCE

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 .
   1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9 . Label each individual glazed lite.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amweld Building Products, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Steelcraft; an Ingersoll-Rand company.
5. Neoporte
6. Brombal

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

G. Mineral-Fiber Insulation: ASTM C 665, Type I.

H. Glazing: Division 08 Section "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Comply with ANSI/SDI A250.8.
   1. Design: Flush panel.
   2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, or mineral-board, with vertical steel stiffeners.
      a. Fire Door Core: As required to provide fire-protection ratings indicated.
      b. Thermal-Rated (Insulated) Doors: R-value of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
         1) All exterior doors unless otherwise noted.
   3. Vertical Edges for Single-Acting Doors: Beveled edge, 1/8 inch in 2 inches.
   4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch thick, end closures or channels of same material as face sheets.
   5. Tolerances: SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Comply with ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush) Model 2 (Seamless).
   2. Fabricate doors from 18 gauge steel sheets.
   3. Galvanize.

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush) Model 2 (Seamless).
   2. Fabricate doors from 18 gauge steel sheets.
   3. Galvanize.

D. Hardware Reinforcement: ANSI/SDI A250.6.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated. Knock down frames are not acceptable.
3. Fabricate frames from 16 gauge steel sheet.
4. Galvanize.

C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated. Knock down frames are not acceptable.
3. Fabricate frames from 16 gauge steel sheet.
4. Galvanize.

D. Hardware Reinforcement: ANSI/SDI A250.6.

E. Bituminous Coating: Provide bituminous coating on backs of frames mounted in masonry or concrete construction.

2.5 FRAME ANCHORS

A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

B. Floor Anchors: Formed from same material as frames and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 STOPS AND MOLDINGS

A. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

B. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, same material as frames.

2.7 LOUVERS

A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.

1. Blade Type: Vision proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide louvers to meet rating indicated.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.8 FABRICATION

A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

B. Hollow Metal Doors:
1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.

C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Two anchors per jamb up to 60 inches high.
      2) Three anchors per jamb from 60 to 90 inches high.
      3) Four anchors per jamb from 90 to 120 inches high.
      4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
   b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Three anchors per jamb up to 60 inches high.
      2) Four anchors per jamb from 60 to 90 inches high.
      3) Five anchors per jamb from 90 to 96 inches high.
      4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.
   a. Single-Door Frames: Three door silencers.
   b. Double-Door Frames: Two door silencers.

D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with electrical Sections.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: ANSI/SDI A250.10.

B. Galvanized Steel Doors, Louvers, Panels, and Frames: As indicated fabricate doors, panels, and frames from galvanized steel sheet according to SDI 112. Close top and bottom edges of doors flush as an integral part of door construction or by addition of minimum 0.0635-inch- thick galvanized steel channels, with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. At fire-protection-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable glazing stops located on secure side of opening.
   d. Install door silencers in frames before grouting.
   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

D. Testing: Issue certified report documenting compliance of installed door and frame assemblies to specified acoustical performance requirements.

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 1113

SECTION 08 3113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes access doors and frames for walls and ceilings.

1.2 SUBMITTALS

A. Product Data: For each type of access door and frame indicated.

B. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

C. Finish Samples: Provide manufacturer's full range of available baked enamel colors.

1.3 QUALITY ASSURANCE

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to 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 for vertical access doors and frames.
   2. ASTM E 119 for horizontal access doors and frames.

1.4 COORDINATION

A. If retaining this Article, also retain "Schedule" Paragraph in "Submittals" Article.

B. 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 STEEL MATERIALS

A. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Factory-Primed Finish: Manufacturer's standard shop primer.
      a. For use at drywall ceilings and walls unless otherwise noted. Field paint to match adjacent painted finish.

2. Baked-Enamel Finish: To be selected by Architect from manufacturer's full range of colors. Minimum dry film thickness of 2 mils.
   a. For use on all prefinished ceilings and walls unless noted otherwise.

C. Drywall Beads: 0.0299-inch zinc-coated steel sheet to receive joint compound.

D. Plaster Beads: 0.0299-inch zinc-coated steel sheet with flange of expanded metal lath.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. J. L. Industries, Inc.
2. Larsen's Manufacturing Company.
3. Milcor Inc.

B. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
1. Locations: Wall and ceiling.
2. Door: Minimum 0.060 inch thick sheet metal.
3. Frame: Minimum 0.060 inch thick sheet metal with 1 inch wide, surface-mounted trim.
4. Hinges: Spring-loaded, concealed-pin type.
5. Lock: Manufacturer's standard cylinder.

C. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
1. Locations: Wall and ceiling surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060 inch thick sheet metal with 1 inch wide, surface-mounted trim.
6. Hinges: Concealed-pin type.
7. Automatic Closer: Spring type.
8. Lock: Manufacturer's standard self-latching device with cylinder lock.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
1. For cylinder lock, furnish two keys per lock and key all locks alike.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 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 08 3113

SECTION 08 3323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of overhead coiling doors:
   1. Non-insulated service doors (manually operated).

B. See Division 05 Section "Metal Fabrications" for miscellaneous steel supports.

C. See Electrical Sections for electrical service and connections for powered operators and accessories.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
   1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. American Society for Testing and Materials (ASTM) A 240 Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, Strips.

1.4 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

B. Shop Drawings: Include plans, elevations, sections, details, and attachment to other work.
   1. Provide drawings indicating guide details, head and jamb conditions, spring shafts, anchorage, accessories, finish colors, patterns and textures, operator mounts and other related information.
   2. Regulatory Requirements and Approvals: Provide shop drawings in compliance with local Authority Having Jurisdiction (AHJ).

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Certifications: Submit manufacturer's certificate that products meet or exceed specified requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide Overhead Door Model 652 as manufactured by Overhead Door Corp. or equal product by one of the following:
   1. Cookson Company.
   2. Cornell Iron Works Inc.
   3. Raynor Garage Doors
   4. Wayne Dalton Corp.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Interlocking slats in a continuous length for width of door of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door.
   1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled stainless steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.
   2. Slat type: Flat profile.
   3. Sound Transmission Class Rating: STC 21
   4. Galvanized Steel Finish: Clear Anodized

B. Endlocks: Malleable-iron casings, secured to curtain slats to comply with wind load.

C. Bottom Bar: 2 angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick to suit type of curtain slats.
   1. Astragal: Replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene; as a cushion bumper for interior door.

D. Steel Door Curtain Jamb Guides: Steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

E. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.
   1. Steel Door Hoods: Minimum 0.028-inch thick, hot-dip galvanized steel sheet that matches slat steel.
   2. Shape: Round.

F. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch- thick, replaceable, continuous sheet secured to inside of hood.
   1. Motor-Operated Doors: Combination bottom weatherseal and sensor edge.
   2. Jamb Seals: Replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.

G. Push/Pull Handles: Lifting handles on each side of door, finished to match door.
   1. Provide pull-down straps or pole hooks for doors more than 84 inches high.

H. Slide Bolt: Engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

I. Chain Lock Keeper: Suitable for padlock.

J. Counterbalancing Mechanism: Adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
   1. Mounting Brackets: Cast iron or cold-rolled steel plate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports

B. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion, and with weathertight fit around entire perimeter.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain doors. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 08 3323

SECTION 087100 – DOOR HARDWARE

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 commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section "Hollow Metal Doors and Frames".

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

D. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.

5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closer bodies.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - MacPro Series.

2.3 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

   a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.4 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Manufacturers:

   a. Corbin Russwin Hardware (RU).

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Manufacturer's Standard.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key locks to match Owner's existing system.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder:
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) – ML2000 Series.

2.6 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) - DL4100 Series.

2.7 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.8 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as

required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.

8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

9. Extended cycle test: Devices to have been cycle tested in ordinance with ANSI/BHMA 156.3 requirements to 9 million cycles.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.

11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.

1. Static Load Force Resistance: Minimum 3000 lbs certified independent tested.

2. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ED4000S / ED5000S Series.

2.9 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Manufacturers:

   a. LCN Closers (LC) - 4040XP Series.
   b. Norton Door Controls (NO) – 9500 Series.

2.10 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width

and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

   a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.11 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

   a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.12 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.13 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.14 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch-Out Report): Reference Division 01 Section "Closeout Procedures". Final inspect installed door hardware and state in report whether work complies with or deviates from specification requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer's Abbreviations:

1. MK - McKinney
2. RO - Rockwood
3. RU - Corbin Russwin
4. NO - Norton
5. PE - Pemko
6. OT - Other

Hardware Sets

Set: 1.0
Doors: 103, 104
Description: Ext - Pair - Storeroom - MFB - Closer/stop

6	Hinge, Full Mortise	MPB91xNRP 4-1/2" x 4"	US32D	MK
2	Flush Bolt	555	US26D	RO
1	Storeroom Lock	ML2059 102E2	630	RU
2	Surface Closer	CLP9500	689	NO
2	Armor Plate	K1050 30" 4BE CSKCSK	US32D	RO
1	Threshold	2727A		PE
1	Rain Guard	346C		PE
1	Gasketing	303AS		PE
2	Sweep	345AV		PE
1	Astragal	S771D		PE

Set: 2.0
Doors: 110
Description: Ext - Sgl - Storeroom - Closer - HO

3	Hinge, Full Mortise	MPB91xNRP 4-1/2" x 4"	US32D	MK
1	Storeroom Lock	ML2059 102E2	630	RU
1	Surface Closer	9500	689	NO
1	Armor Plate	K1050 30" 4BE CSKCSK	US32D	RO
1	Door Stop & Holder	490	US26D	RO
1	Threshold	2727A		PE
1	Rain Guard	346C		PE
1	Gasketing	303AS		PE
1	Sweep	345AV		PE

Set: 3.0
Doors: 105, 106
Description: Ext - Sgl - Storeroom - Closer/stop

3	Hinge, Full Mortise	MPB91xNRP 4-1/2" x 4"	US32D	MK
1	Storeroom Lock	ML2059 102E2	630	RU
1	Surface Closer	CLP9500	689	NO
1	Armor Plate	K1050 30" 4BE CSKCSK	US32D	RO
1	Threshold	2727A		PE
1	Rain Guard	346C		PE
1	Gasketing	303AS		PE
1	Sweep	345AV		PE

Notes:
Hollow metal frame manufacturer to provide weather stripping in the Thermal Break frame.

Set: 4.0
Doors: 101A
Description: Ext - Sgl - Entry - Closer/stop

3	Hinge, Full Mortise	MPB91xNRP 4-1/2" x 4"	US32D	MK
1	Office Lock	ML2051 102E2	630	RU
1	Surface Closer	CLP9500	689	NO
1	Armor Plate	K1050 30" 4BE CSKCSK	US32D	RO

1	Threshold	2727A		PE
1	Rain Guard	346C		PE
1	Gasketing	303AS		PE
1	Sweep	345AV		PE

Set: 5.0
Doors: 101C
Description: Sgl - Classroom - Closer - KP

3	Hinge, Full Mortise	MPB91 4-1/2" x 4-1/2"	US32D	MK
1	Classroom Lock	ML2055 102E2	630	RU
1	Surface Closer	9500	689	NO
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	W/F Stop	406 / 441CU	US26D	RO
1	Gasketing Sgl	S88BL		PE

Set: 6.0
Doors: 108
Description: Sgl - Privacy - Closer

3	Hinge, Full Mortise	MPB91 4-1/2" x 4-1/2"	US32D	MK
1	Privacy Lock	ML2060 102E2	630	RU
1	Surface Closer	CLP9500	689	NO
1	Armor Plate	K1050 30" 4BE CSKCSK	US32D	RO
1	Threshold	2727A		PE
1	Rain Guard	346C		PE
1	Gasketing	303AS		PE
1	Sweep	345AV		PE

Set: 7.0
Doors: 102
Description: Sgl - Office

3	Hinge, Full Mortise	MPB91 4-1/2" x 4-1/2"	US32D	MK
1	Office Lock	ML2051 102E2	630	RU
1	W/F Stop	406 / 441CU	US26D	RO
1	Silencer - Metal Frame	608		RO

Set: 8.0
Doors: 107, 109
Description: Sgl - Push/Pull - Closer - KP

3	Hinge, Full Mortise, Hvy Wt	MPB99xNRP 4-1/2" x 4-1/2"	US32D	MK
1	Deadbolt	DL4117	626	RU
1	Push Plate	70E	US32D	RO
1	Pull Plate	111x70C	US32D	RO
1	Surface Closer	9500	689	NO
1	Armor Plate	K1050 30" 4BE CSKCSK	US32D	RO
1	W/F Stop	406 / 441CU	US26D	RO
1	Threshold	2727A		PE
1	Gasketing	303AS		PE
1	Sweep	345AV		PE

Set: 9.0

Doors: 112, 113, 114
Description: Sgl - Gate - Rim/EO

1	V40XW-36 WITH WEATHERIZED EXIT ALARM (EBXW); 711 FINISH, WITH	
2	INTEGRATED CYLINDER LOCK	DETEX
1	GTSTKBKT – STRIKE LATCH RECEIVER BRACKET	DETEX
1	GTPLGRD – GATE LATCH PROTECTOR	DETEX
1	GTPL – GATE PLATE	DETEX
1	03GS FUNCTION CYLINDER TRIM	DETEX
1	EA. CYLINDER 3080-US26D	CR
2	EA. SPRING-LOADED SELF-CLOSING HOT DIP GALVANIZED CHAINLINK GATE HINGE	HVR

Notes: Balance of hardware by gate provider.

Set: 10.0
Doors: 100A, 100B
Description: Sgl - Gate - Rim/NL

3	V40XW-36 WITH WEATHERIZED EXIT ALARM (EBXW); 711 FINISH, WITH	
4	INTEGRATED CYLINDER LOCK	DETEX
1	GTSTKBKT – STRIKE LATCH RECEIVER BRACKET	DETEX
1	GTPLGRD – GATE LATCH PROTECTOR	DETEX
1	GTPL – GATE PLATE	DETEX
1	03GS FUNCTION CYLINDER TRIM	DETEX
1	EA. CYLINDER 3080-US26D	CR
2	EA. SPRING-LOADED SELF-CLOSING HOT DIP GALVANIZED CHAINLINK GATE HINGE	HVR

Notes: Balance of hardware by gate provider.

Set: 11.0
Doors: 101B, 111, 115, 116, 117
Description: OH Door - All hdw BO

1	ALL HARDWARE BY DOOR PROVIDER.	OT

END OF SECTION 087100

SECTION 08 8000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Doors.
   2. Windows

1.2 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.3 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

   1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.4 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Final Acceptance.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
1. Warranty Period: 10 years from date of Final Acceptance.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to 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.
1. Warranty Period: 10 years from date of Final Acceptance.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

2.3 INSULATING GLASS

A. Manufacturers: Subject to compliance with requirements, provide the following :
1. AGC Glass Company, Inc.

2. Pikington North America
3. PPG Industries, Inc.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
1. Sealing System: Dual seal.
2. Spacer: Manufacturer's standard spacer material and construction.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.5 GLAZING SEALANTS

A. General:
1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 INSULATING-GLASS TYPES

A. Glass Type G1: Clear fully tempered float glass.
   1. Thickness: 1 inch.
   2. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by

preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Apply heel bead of elastomeric sealant.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and

pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 08 8000

SECTION 08 9119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Extruded aluminum stationary louvers with drainable blades.

1.3 REFERENCES

A. AAMA 605.2 - High Performance Organic Coatings on Architectural Extrusions and Panels.

B. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

C. AMCA 511 - Certified Ratings Program for Air Control Devices.

1.4 SUBMITTALS

A. Comply with requirements of Section 01330 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data including performance data.

C. Shop Drawings: Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.

D. Samples: Submit sample of louver to show frame, blades, bird screen, gutters, downspouts, vertical supports, sill, accessories, finish, and color.

1.5 QUALITY ASSURANCE

A. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Horizontal, Sightproof, Drainable-Blade Louver
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Ruskin Manufacturing ELF375DX, or comparable product by one of the following:

      a. Air Balance Inc.; a Mestek company.
      b. Air Flow Company, Inc.
      c. Airolite Company, LLC (The).
      d. All-Lite Architectural Products.
      e. American Warming and Ventilating; a Mestek company.
      f. Arrow United Industries; a division of Mestek, Inc.
      g. Construction Specialties, Inc.
      h. Industrial Louvers, Inc.
      i. Ruskin Company; Tomkins PLC.

2.2 EXTRUDED ALUMINUM STATIONARY LOUVERS

A. Fabrication:
   1. Model: ELF375DX.
   2. Performance Ratings: AMCA licensed.
   3. Frame:
      a. Material: Extruded aluminum, Alloy 6063-T5.
      b. Wall Thickness: 0.081 inch (2.1 mm), nominal.
      c. Depth: 4 inches (102 mm).
      d. Downspouts and caulking surfaces.
   4. Blades:
      a. Style: Drainable.
      b. Material: Extruded aluminum, Alloy 6063-T5.
      c. Wall Thickness: 0.081 inch (2.1 mm), nominal.
      d. Angle: 37.5 degrees.
      e. Centers: 5-3/32 inches (129 mm), nominal.
   5. Bird Screen:
      a. Material: Aluminum,n1/2 inch mesh x 0.063 inch (13 mm mesh x 1.6 mm), intercrimp.
      b. Frame: Removable, rewireable.
   6. Gutters: Drain gutter in head frame and each blade.
   7. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.
   8. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches (3,048 mm).
   9. Sill: Steeply angled integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.
   10. Assembly: Factory assemble louver components. All welded construction.

B. Performance Data:
   1. Based on testing 48 inch x 48 inch (1,219 mm x 1,219 mm) size unit in accordance with AMCA 500.
   2. Free Area: 54 percent, nominal.
   3. Free Area Size: 8.58 square feet (0.80 m^2).
   4. Maximum Recommended Air Flow Thru Free Area: 873 feet per minute (266 m/min).
   5. Air Flow: 7,490 cubic feet per minute (212 m^3/min).
   6. Maximum Pressure Drop: 0.15 inches w.g. (0.04 kPa).
   7. Water Penetration: Maximum of 0.01 ounces per square foot (3.1 g/m^2) of free area at an air flow of 873 feet per minute (266 m/min) free area velocity when tested for 15 minutes.

C. Design Load: Incorporate structural supports required to withstand wind load per local authorities having jurisdiction and structural design loads.

2.3 ACCESSORIES

A. Blank-Off Panels: 1 inch (25 mm), aluminum skin, insulated core, factory installed with removable screws and neoprene gaskets.

B. Hinged Frame: Continuous piano hinge attached to subframe.

C. Rear Security Bars: Aluminum, 3/4 inch x 1/2 inch (19 mm x 13 mm), welded to louver.

D. Filter Racks: Formed channel racks to accept standard [1 inch (25 mm)] [2 inch (51 mm)] thick filters. Unused bottom portion blanked off with 0.040 inch (1 mm) aluminum sheet.

E. Bird Screens:

F. Insect Screens:

G. Extended Sills: Extruded aluminum, Alloy 6063-T5. Minimum nominal wall thickness 0.060 inch (1.5 mm).

H. Visible Mullions: Manufacturer's standard horizontal or vertical visible mullions for architectural accent as indicated on drawings.

2.4 FACTORY FINISH

A. Standard mill finish.

B. Prime Coat:
1. Apply alkyd prime coat following chemical cleaning and pretreatment.
2. Primer preparation for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect areas to receive louvers. Notify the Architect 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 07920.

D. Apply field topcoat within 6 months of application of shop prime coat. Apply field topcoat as specified in Section 09910.

3.3 CLEANING

A. Clean louver surfaces in accordance with manufacturer's instructions.

B. Repair minor damaged surfaces as directed by Architect.

END OF SECTION

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gypsum board for ceilings

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. CertainTeed Corp.
2. Georgia-Pacific Gypsum LLC.
3. National Gypsum Company.
4. Temple-Inland.
5. USG Corporation.
6. American Gyp.
7. Lafarge North America, Inc.

B. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch, Type X
2. Long Edges: Tapered.

C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: As indicated 5/8 inch, Type X.

2. Long Edges: Tapered.

3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.2 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.

2. Corners: At all exposed corners install Fry Reglet 1¼ inch corner trim – DMCT – 1250 from finished floor to ceiling. Paint corner trim to match adjacent partition.

3. Control Joints: National Gypsum 0.093 Zinc-coated control joint, or equal as approved by the Architect.

4. Edge Trim: At ceiling perimeter install Fry Reglet 1¼ inch ceiling trim – DRMCT-50-50. Paint trim to match adjacent partition.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.

2.3 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Comply with ASTM C 840.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. Install trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

E. Prefill open joints, rounded or beveled edges, and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

2. Level 3: Where indicated on Drawings.

3. Level 4: Where indicated on Drawings

   a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

4. Level 5: At panel surfaces that will be exposed to view unless otherwise indicated.

   a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

H. Protect adjacent surfaces from drywall compound and texture finishes and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

I. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 09 6513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient molding accessories.

1.2 SUBMITTALS

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

B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.3 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.4 EXTRA MATERIALS

A. Furnish extra materials that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Furnish not less than 10 lineal feet for each 500 lineal feet, or fraction thereof, of each type, color, and size of resilient accessory installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong World Industries, Inc.
      b. Johnsonite.
      c. Roppe Corporation, USA.

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TS (rubber, vulcanized thermoset).
2. Manufacturing Method: Group I (solid, homogeneous).
3. Style: Straight (flat or toeless) at carpeted flooring; Cove (base with toe) at all other locations.

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed, back cut and bent to conform to corners.

G. Inside Corners: Job formed, back cut and bent to conform to corners.

H. Finish: Matte.

I. Colors and Patterns: As indicated on Drawings.

2.2 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:
1. Manufacturers: Subject to compliance with requirements, provide products by resilient base manufacturer.

B. Description: Reducer strips for floor finish transitions between carpeted and resilient floor covering.

C. Material: Rubber.

D. Profile and Dimensions: Manufacturer's standard unless otherwise indicated. Thickness to match adjacent materials.

E. Color: Match resilient base.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. 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.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 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.

3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet resilient floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Cover resilient products until Substantial Completion.

END OF SECTION 09 6513

SECTION 09 8000 – SPECIAL COATINGS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Exterior / Interior coating systems.
      a. Wall.
      b. Floor.
      c. Exposed Structure.
      d. Miscellaneous metals.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each system component required.

B. Samples for Verification: For each system required, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project. For each system required, demonstrate the full range of color and texture.

C. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

D. Material Test Reports: For each system component.

E. Maintenance Data: For each system to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to system manufacturer.
   1. Engage an installer who is certified in writing by system manufacturer as qualified to apply systems indicated; and, who possesses a minimum of 3 years documented experience on projects with 1/8" epoxy broadcast with similar size and scope.

B. Source Limitations: Obtain primary materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

C. Mockups of Flooring System: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Apply full-thickness mockups on 48-inch- (1200-mm-) square floor area selected by Architect.
      a. Include 48-inch (1200-mm) length of integral cove base.
   2. Do not begin installation until Architect has approved mockups.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

4. Approved mock-up shall remain on site until approved completion of the floor and walls.

D. Pre-Application Conference: Prior to making field samples and placing order for materials, the Architect, Contractor, installer and manufacturer's representative shall meet and agree on methods and schedule for application.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects; store as recommended by manufacturer.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with system manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting system application.
1. Permanent lighting shall be in place and functional prior to installation of floor and wall system.
2. Minimum surface and air temperature shall be 60 degrees F.

B. Close spaces to traffic during flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

PART 2 – PRODUCTS

2.1 COATING SYSTEMS (EXY1 and EXY2)

A. Manufacturer: Tnemec Company 405-755-7040 or equal as approved by Architect.

B. **CMU – Humid And Dry Areas – Check-in, Office, Storage:**
1. Surface Preparation: All surfaces shall be clean, dry, and free of oil, grease, or other contamination. Allow mortar to cure 14 days. Level protrusions and mortar spatter.
2. Coating System:
Block Filler: Tnemec Series 130-6601 Envirofill 60 – 80 sq. ft./gal. (use squeegee to provide smooth surface)
1st Coat: Tnemec Series 66 HB Epoxoline 4.0 – 6.0 mils DFT
2nd Coat: Tnemec Series 290 CRU 2.0 – 3.0 mils DFT
Total Thickness Minimum 7.0 mils DFT
3. 1st and 2nd coat colors shall be different colors so as to verify 2 coat system.

C. **CMU – Wet Areas – Family Changing and Mens/Womens:**
1. Surface Preparation: All surfaces shall be clean, dry, and free of oil, grease, or other contamination. Allow mortar to cure 14 days. Level protrusions and mortar spatter.
2. Coating System:
Block Filler: Tnemec Series 54-660 Masonry Filler 75 – 100 sq. ft./gal.
(use squeegee to provide smooth surface)
1st Coat: Tnemec Series 66 HB Epoxoline 4.0 – 6.0 mils DFT
2nd Coat: Tnemec Series 290 CRU 2.0 – 3.0 mils DFT

Total Thickness Minimum 7.0 mils DFT

3. 1st and 2nd coat colors shall be different colors so as to verify 2 coat system.

B. Exposed Metals – **Fascia and Hollow Metal at Pool Equipment, Acid Feed, Chlorine Room:**

1. Surface Preparation: All surfaces shall be clean, dry, and free of oil, grease, or other contamination. Clean all surfaces as per SSPC-SP1 Solvent Cleaning. Pre pare bare metal or damaged shop primer as per SSPC-SP3 Power Tool Cleaning. Spot prime these areas using Tnemec Series 135 Chembuild applied at 4 to 6 dry mils.
2. Coating System:
   Field Primer: Tnemec Series 135 Chembuild 4.0 – 6.0 mils DFT
   Finish Coat: Tnemec Series 290 CRU 2.0 – 3.0 mils DFT
   Total Thickness Minimum 7.0 mils DFT
3. 1st and 2nd coat colors shall be different colors so as to verify 2 coat system.

C. Guardrails – **Ferrous Metal (at Pool Equipment):**

1. Surface Preparation: All surfaces shall be clean, dry, and free of oil, grease, or other contamination. Prepare all surfaces as per SSPC-SP6 Commercial Blast Cleaning. Prepare bare metal or damaged shop primer as per SSPC-SP3 Power Tool Cleaning. Spot prime these areas using Tnemec Series 135 Chembuild applied at 4 to 6 dry mils.
2. Coating System:
   Shop Prime: Tnemec Series 66 HB Epoxoline 3.0 - 5.0 mils DFT
   Field Prime: Tnemec Series 135 Chembuild 4.0 - 6.0 mils DFT
   Finish Coat: Tnemec Series 290 CRU 2.0 - 3.0 mils DFT
   Total Thickness Minimum 10.0 mils DFT

D. Concrete Floors – **Family Changing, Womens, and Mens**:

1. Surface Preparation: All surfaces shall be clean, dry, and free of oil, grease, or other contamination. Allow new concrete to cure 28 days. Perform moisture testing as per ASTM F 1869. If moisture content exceeds 3 pounds per 1,000 sq. ft. in 24 hour period, use Tnemec Ultra-Tread MVT Series 241 as a moisture control system. Prepare concrete surfaces as per SSPC-SP13 or ICRI CSP1-3. Install 4" rolled radius cove base where noted on plans or room schedule.
2. Coating System:
   Primer: Tnemec Series 201 Epoxoprime 6.0 – 8.0 mils DFT
   Broadcast: Tnemec Series 222 Deco-Tread 1/8" DFT
   Seal Coat: Tnemec Series 284 Deco-Clear 10.0 – 12.0 mils DFT
   Topcoat: Tnemec Series 295 Clear CRU 2.0 – 3.0 mils DFT
   (w/ 44-600 UV additive)
   Total Thickness Minimum 1/8 inch DFT

E. Exterior Surfaces **Exposed Steel Surfaces – Decorative Handrails, Tube Steel Frame:**

1. Surface Preparation: All surfaces shall be clean, dry, and free of oil, grease, or other contamination. Prepare all surfaces as per SSPC-SP6 Commercial Blast Cleaning. Prepare bare metal or damaged shop primer as per SSPC-SP3 Power Tool Cleaning. Spot prime these areas using Tnemec Series 135 Chembuild applied at 4 to 6 dry mils.
2. Coating System:
   Shop Prime: Tnemec Series 66 HB Epoxoline 3.0 - 5.0 mils DFT
   Field Prime: Tnemec Series 73 Endura-Shield 2.0 - 3.0 mils DFT
   Clear Coat: Tnemec Series 76 Endura-Clear 1.0 - 2.0 mils DFT
   Total Thickness Minimum 7.0 mils DFT

2.2 ACCESSORY MATERIALS

A. Patching and Fill Material: Resinous product of or approved by system manufacturer and recommended by manufacturer for application indicated.

B. Joint Sealant: As specified in Division 7 and as recommended by system manufacturer for type of service and joint condition indicated.

2.3 MIXING AND TINTING

A. Mix and thin materials in strict accordance with manufacturer's latest printed instructions.

B. Do not use material beyond manufacturer's recommended pot life.

C. Project site tinting will not be allowed.

PART 3 – EXECUTION

3.1 INSPECTION

A. Verify surfaces to be coated are dry, clean and ready to accept prime coat in accordance with manufacturer's recommendations.

B. Notify Architect in writing of unacceptable conditions prior to commencing application.

C. Do not begin work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare and clean substrates according to system manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for system application.

B. Protect surrounding and adjacent surfaces in manner recommended by floor coating manufacturer.

C. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with epoxy system.
   1. Allow new concrete scheduled to be coated to cure 28 days at 75° F. prior to application of coating system.
   2. Mechanically abrade concrete after cleaning to provide "tooth and suction". Prepare all horizontal surfaces as per SSPC-SP13 using shot blast equipment.
   3. Repair damaged and deteriorated concrete according to system manufacturer's written recommendations.
   4. Verify that concrete substrates are dry.
      a. Tests: Test concrete surfaces to be coated in accordance with ASTM F 1869 prior to installation of floor coating system. Test should be performed during normal HVAC operation. Report findings to Architect. Floor coating should not commence unless test values are less than 3 pounds.
   5. Verify that concrete substrates have neutral Ph and that epoxy system will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

D. Epoxy Materials: Mix components and prepare materials according to system manufacturer's written instructions.

E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through epoxy system according to manufacturer's written recommendations.

3.3 APPLICATION

A. General: Apply components of system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of system to substrate, and optimum intercoat adhesion.
   2. Cure system components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. Joints: At substrate expansion and isolation joints, provide joint in epoxy system to comply with system manufacturer's written recommendations.
      a. Apply joint sealant to comply with manufacturer's written recommendations.
   4. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
   5. Apply filler and grout coat, of type recommended by system manufacturer to fill voids in surface of final body coat and to produce wearing surface indicated.
   6. Apply topcoat(s) in number of coats indicated for system and at spreading rates recommended in writing by manufacturer.

B. Flooring:
   1. Whenever possible, schedule work to ensure that a wet edge is maintained. Work stoppages should be scheduled so that there is no break during the application of a coat in progress, if possible. Where a break in a coat is made, that area should be sanded smooth so that no line remains.
   2. Exposed Perimeters:
      a. All exposed perimeter edges of the broadcast overlay, including door ways, traffic aisle sides, drains, etc. must be saw cut. Areas that cannot be reached with the saw, or are difficult to saw cut shall be chipped.
      b. Saw cut shall be a minimum of 1/4" deep and 1/4" wide.
      c. Prime saw cut areas with epoxy primer.
      d. Install flooring so that it folds into saw cut.

C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
   1. Cut coves as required for joints

B. Wall System:
   1. Prime coat all surfaces with epoxy primer 30 minutes prior to spray application.
   2. Whenever possible, schedule work to ensure that a wet edge is maintained. Work stoppages should be scheduled so that there is no break during the application of a coat in progress, if possible. Where a break in a coat is made, that area should be sanded smooth so that no line remains.
   3. Spray apply epoxy wall system, let cure a minimum of 12 hours.
   4. Pole sand entire surface to remove any burrs, and tack wipe.
   5. Topcoat entire area with epoxy finish coat.

3.4 FIELD QUALITY CONTROL

A. Initiate and maintain for duration of Project field quality control program using certified calibration and testing devices and to ensure conformance with application requirements.
   1. Furnish and maintain at Project site the following fully calibrated testing and inspection devices:
      a. Wet Mil Gauge
      b. Tooke Gauge
      c. Sling Psychrometer

B. Manufacturer's representative shall visit job site and verify that materials are applied in accordance with specification requirements.

3.5 CLEANING AND PROTECTING

A. Protect epoxy systems from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by system manufacturer.

END OF SECTION

SECTION 09 9113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
   1. Steel.
   2. Galvanized metal.

1.2 SUBMITTALS

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

B. Samples: For each finish and for each color and texture required.

C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.3 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.

1.4 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 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 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. Acceptable Manufacturers:
   1. Benjamin Moore & Company.
   2. Devoe Paint.
   3. ICI Paints.
   4. PPG Industries.
   5. Pratt & Lambert Paints.
   6. Sherwin Williams Company.

C. Color Schedule: Refer to drawings.

2.2 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.
   1. Solvent based, alkyd type, anti-corrosive primer for use with ferrous metals. Topcoat with alkyd based paint.
   2. VOC Content: E Range of E2.

B. Cementitious Galvanized-Metal Primer: MPI #26.
   1. Solvent based primer composed of linseed oil/alkyd resin and Portland cement for use on cleaned galvanized metal. Topcoat with latex paint.
   2. VOC Content: E Range of E1.

2.3 EXTERIOR ALKYD PAINTS

A. Exterior Alkyd Enamel (Gloss): MPI #9 (Gloss Level 6).
   1. Alkyd based for use on primed metal surfaces.
   2. VOC Content: E Range of E1.

2.4 FLOOR COATINGS

A. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
   1. Water based, acrylic co-polymer emulsion type, clear sealer for interior and exterior horizontal concrete floors and walkways.
   2. VOC Content: E Range of E2.

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. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. 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.

C. 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.

D. 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.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates:
   1. Alkyd System: MPI EXT 5.1D.
      a. Prime Coat: Alkyd anticorrosive metal primer.
      b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
      c. Topcoat: Exterior alkyd enamel (gloss).

B. Galvanized-Metal Substrates:
   1. Latex Over Water-Based Primer System: MPI EXT 5.3H.
      a. Prime Coat: Waterborne galvanized-metal primer.
      b. Intermediate Coat: Exterior latex matching topcoat.
      c. Topcoat: Exterior latex (semigloss).

END OF SECTION 09 9113

SECTION 09 9123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Steel.
2. Galvanized metal.
3. Gypsum Board

1.2 SUBMITTALS

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

B. Samples: For each finish and for each color and texture required.

C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.3 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.

1.4 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 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 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. Acceptable Manufacturers:
1. Benjamin Moore & Company.
2. Devoe Paint.
3. ICI Paints.
4. PPG Industries.
5. Pratt & Lambert Paints.
6. Sherwin Williams Company.

C. Color Schedule: Refer to drawings

2.2 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.
1. Water based latex sealer used on interior plaster, concrete and gypsum wallboard surfaces. Topcoat with latex or alkyd based paint.
2. VOC Content: E Range of E2.
3. Environmental Performance Rating: EPR 2.

B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.3 METAL PRIMERS

A. Quick-Drying Alkyd Metal Primer: MPI #76.
1. Solvent based, modified alkyd, fast drying, anti-corrosive primer for cleaned interior and exterior steel. Topcoat with alkyd based paint.
2. VOC Content: E Range of E2.

B. Waterborne Galvanized-Metal Primer: MPI #134.
1. Water based metal primer, composed of anti-corrosive pigments and acrylic resins, for cleaned/etched galvanized metal. Topcoat with latex based paint.
2. VOC Content: E Range of E3.
3. Environmental Performance Rating: EPR 3.

2.4 LATEX PAINTS

A. Interior Latex (Flat): MPI #53 (Gloss Level 1).
1. Water based latex paint with a flat finish for use on gypsum board ceilings.
2. VOC Content: E Range of E3.
3. Environmental Performance Rating: EPR 2.5.

B. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).
   1. Water based latex-based paint with a finish between a high side sheen flat and a 'satin-like' finish or a low semi-gloss. Use on primed/sealed interior masonry, plaster and gypsum board walls.
   2. VOC Content: E Range of E3.
   3. Environmental Performance Rating: EPR 3.

C. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).
   1. Water based latex-based paint with a semi-gloss finish. Use on primed/sealed interior wood and metal trim and doors and plaster.
   2. Use anti-microbial paint on gypsum wallboard at mechanical, toilet, and janitor room walls and ceilings.
   3. VOC Content: E Range of E2.
   4. Environmental Performance Rating: EPR 3.

2.5 ALKYD PAINTS

A. Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).
   1. Solvent based, gloss alkyd paint for primed interior wood and metal surfaces. Primarily used on trim, doors and frames.
   2. VOC Content: E Range of E2.

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. Wood: 15 percent.
   3. Gypsum Board: 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 AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. 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.

C. 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.

D. 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 other 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. Conduits and junction boxes.
   d. Electrical equipment that is indicated to have a factory-primed finish for field painting.

E. 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.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:
1. Latex Over Sealer System: MPI INT 3.1A.
   a. Prime Coat: Interior latex primer/sealer.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: Interior latex (eggshell).

B. Concrete Masonry Unit Substrates, Nontraffic Surfaces:
1. Latex Over Sealer System: MPI INT 4.2G.
   a. Prime Coat: Interior Epoxy Block filler primer/sealer.
   b. Intermediate Coat: Interior Epoxy matching topcoat.
   c. Topcoat: Interior Epoxy (Semi-gloss).

C. Galvanized-Metal Substrates:
1. Latex System: MPI INT 5.3A.
   a. Prime Coat: Cementitious galvanized-metal primer.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: Interior latex (eggshell).

D. Dressed Lumber Substrates: Including architectural woodwork, doors and base.
   1. Latex System: MPI INT 6.3T.
      a. Prime Coat: Interior latex-based wood primer.
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: Interior latex (semigloss).

E. Wood Panel Substrates: Including medium-density fiberboard.
   1. Latex System: MPI INT 6.4R.
      a. Prime Coat: Interior latex-based wood primer.
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: Interior latex (semigloss).

F. 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) (eggshell) (semigloss).

END OF SECTION 09 9123

SECTION 10 1400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior Panel Signs.
   2. Interior Specialty Signs
   3. Exterior Building Signs.

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 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details for signs.
   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

C. Samples: For each sign type and for each color and texture required.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.1 PANEL SIGNS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. APCO Graphics, Inc.
   2. ASI-Modulex, Inc.
   3. Best Sign Systems Inc.
   4. EMG Graphics Systems, Inc.

B. Exterior and Interior Signs: Wall mounted vandal resistant aluminum.
   1. Surface Finish: Brushed.

2. Edge Condition: Square cut.
3. Corner Condition: Square cut.
4. Thickness: 1/8 inch.
5. Size and Layout: 8 inch x 8 inch.
6. Font: Contrasting color

C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
1. Panel Material: Aluminum.
2. Raised-Copy Thickness: Not less than 1/32 inch.

D. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.
1. Color: As selected by Architect from manufacturer's full range.

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 restroom signs and other configurations indicated.
1. Construct all work to eliminate burrs, cutting edges, and sharp corners.
2. Follow manufacturer's fabricating procedures regarding expansion / contraction, fastening, and restraint of acrylic plastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. 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 of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
1. Mount signs to split face CMU surfaces using vandal resistant fasteners.

3.2 SCHEDULE

A. Provide wall mount ADA compliant signage at all locations required by IBC 2015, ADA-ABA and ANSI 117.1 as follows and as indicated on Drawings:
   a. Emergency Evacuation
   b. Fire Protection Equipment
   c. Fire Department Connections
   d. Containment area signage as required for Pool Equipment, Acid, and Chlorine Rooms.
   e. Room Identification (Plaques): One at each room entry.
   f. Exterior Building Signage:
      i. Building Entry
         1. Building address as indicted on Drawings.
         2. Room identifications

END OF SECTION 10 1400

SECTION 10 1710 – COMPARTMENTS AND CUBICLES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. High-density polyethylene (HDPE) polymer toilet compartments, shower dividers, dressing booths, floor mounted, head rail braced, with double-swing doors.
   2. Attachment hardware.

1.2 REFERENCES

A. American National Standards Institute (ANSI): ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of reinforcements for compartment-mounted grab bars.
   3. Show locations of centerlines of toilet fixtures.
   4. Show overhead support or bracing locations.

C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Partitions must be tested and comply with the criteria for NFPA 286.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

D. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural &

Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide solid plastic toilet compartments, shower dividers, partitions, and screens by Accurate Partitions Corp. or comparable product by one of the following:
   1. Accurate Partitions Corp.
   2. Global Partitions
   3. Scranton Products
   4. Bradley

B. The Drawings indicate size, profiles, and dimensional requirements of the partition system and are based on the specific manufacturer and model indicated. Partition systems having equal characteristics by other manufacturers may be considered provided that deviations in dimensions and profiles are minor and do not change the concept or intended performance as judged by the Architect.

2.2 MATERIALS

A. High-density polyethylene (HDPE) polymer Compartments and Screens that are water resistant and non-absorbent. A heat sinc shall be attached as standard to bottom of all doors and panels:
   1. Panels: 1 inch thickness. Face dimensions as indicated on Drawings.
   2. Doors: 1 inch thickness. Face dimensions as indicated on Drawings.
   3. Pilasters: 1 inch thickness. Face dimensions as indicated on Drawings.
   4. Benches: 1 inch thickness. Face dimensions as indicated on Drawings.
   5. Color: To be selected from manufacturer's full range
   6. Texture: Tough Texture (TT) on vertical surfaces.
   7. Height: Standard or as indicated on Drawings.

B. Material: The HDPE material shall have homogenous color throughout each component with ¼" machined edges for uniformity. Self-lubricating surface shall resist markings from pens, pencils and other writing instruments.

C. Pilaster Shoes: 4 inches high; one-piece stainless steel floor shoe.

D. Headrail: Extruded brite anodized type 6463T5 aluminum channel; anti-grip design.

E. Attachments:
   1. Screws, and Bolts: Stainless steel; tamper proof type.
   2. Wall Mounting Brackets: Continuous, full height, double ear extruded brite anodized type 6463T5 aluminum.
   3. Side Panel to Pilaster Bracket: Continuous, full height, U-channel extruded brite anodized type 6463T5 aluminum.

F. Hardware: Integral pivot hinges, gravity type, double-swing, adjustable for door close positioning; nylon bearings; clear anodized aluminum slide-type door latch; door strike and keeper with rubber bumper; cast alloy chrome plated coat hook and bumper.

G. Shower accessories: Provide rod, hooks, and curtain.

2.3 FABRICATION

A. Hardware and Attachments: Pre-drilled by manufacturer; provide for protection of dissimilar metals.

PART 3 – EXECUTION

3.1 PREPARATION

A. Take site dimensions. Verify correct spacing of plumbing fixtures.

B. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

A. Install secure, rigid, plumb, level, and square in accordance with manufacturer's instructions.
1. Provide for adjustment due to minor floor variations.
2. Install adjacent components for consistency of line and plane.

B. Maintain 1/2 inch space between wall and panels, and between wall and pilasters. Attach continuous panel brackets securely to walls using anchor devices.

C. Attach panels and pilasters to bracket with through sleeve, tamperproof bolts, and nuts. Locate head rail joints at pilaster center lines.

D. Anchor screen panels to walls with continuous bracket in accordance with manufacturer's instructions to suit supporting wall construction.

E. Conceal floor fastenings with pilaster shoes.

F. Equip each door with hinges, one slide-type door latch, and one coat hook and bumper. Align hardware to uniform clearance at vertical edges of doors, not exceeding 1/4 inch.

3.3 ADJUSTING

A. Double Swinging Doors: Adjust hinges to gently return doors to closed position.

END OF SECTION

SECTION 10 2800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Toilet and Bath accessories.
   2. Warm-air dryers.
   3. Underlavatory guards.
   4. Custodial accessories.

1.2 SUBMITTALS

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

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.

C. Maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 TOILET ACCESSORIES

A. Manufacturers: The design for accessories is based on the products specified. Subject to compliance with requirements, provide the named products or comparable products by one of the following manufacturer's:
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment, Inc.
   3. Bradley Corporation.
   4. Koala Kare Corporation.
   5. World Dryer Corporation.

B. Toilet Tissue (Dual-Roll) Dispenser:
   1. Basis-of-Design Product: Bradley 5425.
   2. Description: Two-roll unit tissue dispenser.
   3. Mounting: Surface
   4. Material and Finish: Stainless steel, No. 4 finish (satin).
   5. Lockset: Tumbler type.

C. Napkin Disposal:
   1. Basis-of-Design Product: Bradley 4781-15.
   2. Description: Napkin disposal with wax paper liners.
   3. Mounting: Surface
   4. Material and Finish: Stainless steel, No. 4 finish (satin).
   5. Lockset: Tumbler type.

D. Soap Dispenser (Wall mounted)
   1. Basis-of-Design Product: Bradley 6A01-11
   2. Description: Vertical tank designed for dispensing foam soap.
   3. Mounting: Surface
   4. Capacity: 27 oz.
   5. Materials: Stainless Steel

E. Towel Pin
   1. Basis-of-Design Product: Bradley 9315.
   2. Description: Towel and Utility hook.
   3. Mounting: Surface
   4. Materials: Stainless Steel, No. 8

F. Grab Bars:
   1. Basis-of-Design Product: Bradley 812-001 x 18, 36, and 42.
   2. Mounting: Flanges with concealed fasteners.
   3. Material: Type 304 stainless steel, 18 gauge.
      a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant peened texture in grip area.
   4. Outside Diameter: 1-1/2 inches.
   5. Configuration and Length: Straight, 36 inches long, 42 inches long, and 18 inches long (vertical mount).

G. Baby Changing Station (ADA Compliant):
   1. Basis-of-Design Product: Koala Kare KB101-01
   2. Description: Vertical mounted baby changing station with safety strap. ADA compliant.
   3. Mounting: Surface
   4. Material and Finish: Grey with Stainless steel, No. 4 finish (satin) flange.

H. Channel-Frame Mirror (Tempered Glass):
   1. Basis-of-Design Product: Bradley 781-24362
   2. Description: Mirror with roll-formed channel frame and theft-resistant mounting.
   3. Mounting: Surface
   4. Material and Finish: first quality ¼ tempered glass mirror and stainless steel with bright annealed finish frame.

I. Shower Curtain per Section 10 1710.
   1. Basis-of-Design Product: Bradley 9537
   2. Description: Antimicrobial Shower Curtain with aluminum grommets
   3. Mounting: Surface
   4. Material and Finish: 10 oz nylon-reinforced antimicrobial PVC vinyl fabric, White

J. Shower Curtain Rod per Section 10 1710.
   1. Basis-of-Design Product: Bradley 9538
   2. Description: Shower curtain rod with concealed mounting.
   3. Mounting: Surface
   4. Material and Finish: Stainless steel with satin finish

K. Shower Curtain Hooks per Section 10 1710.

1. Basis-of-Design Product: Bradley 9540
2. Description: Shower curtain hook with rollers
3. Material and Finish: stainless steel

L. Shower Soap Dish (Recessed)
1. Basis-of-Design Product: Bradley. Refer to plumbing fixture schedule on Drawings.
2. Description: Recessed soap dish.
3. Material and Finish: Stainless steel

2.2 WARM-AIR HAND DRYERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.
3. Excel Dryer, Inc.

B. Warm-Air Hand Dryer:
1. Basis-of-Design Product: Thin Air Excel Hand Dryer TA-ABS
2. Mounting: Surface.
3. Operation: Adjustable electronic-sensor activated with timed power cut-off switch.
4. Cover Material and Finish: White Polymer (ABS)
5. Electrical Requirements: 115V, 20A, 2300W, 50/60 Hz, or 208V, 10A, 2400W, 60 Hz.

2.3 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by the following:
1. Truebro by IPS Corporation.
   a. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
   b. Material and Finish: Antimicrobial, molded plastic, white.

2.4 CUSTODIAL ACCESSORIES

A. Mop Holder / Shelf:
1. Basis-of-Design Product: Bradley 9954.
2. Description: Four anti-slip mop holders with spring loaded rubber cam grips; Four stainless steel hooks.
3. Shelf: 22 gauge stainless steel.
4. Material and Finish: 304 Brushed stainless steel (satin).
5. Provide one at each janitor mop sink whether indicated or not.

2.5 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbs., when tested according to ASTM F 446.

END OF SECTION 10 2800

SECTION 10 4100 - PROTECTION SPECIALTIES

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.

1.02 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide extinguishers listed and labeled by FM.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Portable Fire Extinguishers:

a. J.L. Industries, Inc.

b. Kidde: Walter Kidde, The Fire Extinguisher Co.

2.02 PORTABLE FIRE EXTINGUISHERS

A. Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

1. Multipurpose Dry-Chemical Type: UL-rated 2-A:10-B:C, 5-lb nominal capacity, in enameled-steel container.

2.03 ACCESSORIES

A. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

3.03 ADJUSTING, CLEANING, AND PROTECTION

A. Provide final protection and maintain conditions that ensure that fire-protection specialties are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 10 7316 – PREFABRICATED SHADE UMBRELLAS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work to include: All labor, equipment, materials and services incidental to installation of the specified shade structure. Refer also to drawings for shade structure plan and details.

B. All shelter components shall be designed and fabricated per the latest applicable edition of the International Building Code (IBC) and designed to meet site specific snow, wind and seismic load criteria.

C. All structural members shall be designed according to the American Institute of Steel Construction (AISC) and the American Iron and Steel Institute (AISI) specifications.

D. All welding is to be done in accordance with the latest American Welding Society (AWS) standards and all welds are to develop full strength of component parts (E7081 Electrodes).

E. Shade umbrella manufacturer shall submit approved shop drawings and site-specific engineer sealed structural calculations by a registered engineer in the state of the shelter location. 2 copies are required for permitting.

F. Refer to drawings for shelter size, model #, and colors.
Manufacturer's (or approved equal):
- Coverworx Recreational Architecture, 11800 East 9 mile road Warren, MI 48089. www.coverworx.com 586-486-1088.
- Superior Recreational Products, 1050 Columbia Dr, Carrollton, GA 30117 www.superiorrecreationalproducts.com (800) 327-8774

1.2 SUBMITTALS

A. Provide color samples for the specified roof color and for the post frame color. Receive approval from Owner and permit prior to fabrication of structure.

1.3 FOOTINGS AND COLUMNS

A. Standard columns shall have a welded base plate to be anchored into concrete footings. All concrete material and installation shall be supplied by the contractor. Anchor bolts shall be ASTM A-307 and will be provided along with bracing templates by Coverworx. Footing is to be recessed underneath shelter slab as shown on drawings. Required concrete compressive strength is 3500 psi. Refer to drawings for recessed footing design.

1.4 FRAMING MEMBERS:

A. All frame members shall be structural steel tube ASTM A-500 Grade B with ASTM A-36 welded connection plates. Minimum steel tube wall thickness shall be 0.120 (1/8") and minimum connection plate thickness shall be 0.250 (1/4").

B. All framing connections are done using ASTM A-325 grade bolts (included with shelter) within concealed access openings from above and will later be concealed by the roofing. All roof framing shall be flush against the underside of the roof decking to eliminate the possibility of bird nesting.

C. Open framing members such as "I" beams, angle iron and "C" or "Z" channels shall not be used.

D. All frame members shall be blasted and washed to a white condition to completely rid the steel of all rust, oil, grease and contaminates. 3-6 mils of electro-statically applied epoxy primer and 4-6 mils of electro-statically applied TGIC polyester powder coat. Final powder coat is oven cured at 400 degrees. Refer to drawings for specified colors.

1.5 ROOFING AND TRIM

A. All roofing shall be 24ga. Precut steel Multi-Rib panels by McElroy Metal, Inc. Roof panels are Galvalume coated with white bottom and 20 year warranted Kynar 500 top finish color as specified on plan. Panels shall be pre-cut with ribs running with the slope of the roof. Fastened to steel frame using concealed clips and self-tapping screws. Standard roof slope is a 6/12 pitch with a 7'-6" high clear eave height.

B. Roof trim shall be 24ga. pre-finished Galvalume coated steel to match roof color with exposed screws in matching color.

1.6 SHIPPING AND INSTALLATION

A. Prior to delivery of steel members from factory to job site all members shall be wrapped in a protective wrap to protect the factory finish during shipping. Protective wrap should be removed upon receipt of delivery to avoid prolonged exposure to packaging materials which could damage factory finish.

B. Shade Umbrella Manufacturer shall provide complete installation drawings and instructions. Installation shall be performed by a contractor with experience and competence with installation of similar structures. It shall be the responsibility of the installer to properly assemble the shelter as described in installation documents and to construct shelter foundations as specified in supplemental engineering documents.

1.7 WARRANTY

A. Provide 10-year warranty for the entire umbrella to be free from defects in materials and workmanship.

PART 2 – PRODUCTS

2.1 PRODUCTS

A. 12' Shade Umbrella
- Coverworx: Steelworx Single post 12' octagonal Umbrella
- Superior Recreational Products: 12' (AS) Octagonal Center Post Umbrella

END OF SECTION 107316

SECTION 11 6800
WATER PLAYGROUND EQUIPMENT

PART 1 – GENERAL

1.01 DESCRIPTION

A. Provide all labor and equipment needed to install all water playground equipment shown on Drawings. Provide all associated utility connections, including water supply and electrical supply. Provide sleeving, plumbing and electrical work below water playground slab.

B. All water playground equipment is based on Vortex, or approved equal. Refer to Drawings for specific equipment.

C. Water playground equipment installer shall carefully coordinate with water playground slab installer.

1.02 QUALITY ASSURANCE

A. The aquatic play products shall be suitable for installation in municipal and commercial aquatic facilities and public play areas. Products shall be specifically designed for the use by children and adults and follow the ASTM F2461-09 norm.

B. The contractor/installer shall have completed a minimum of two (2) similar Splashpad projects. Provide references and project lists to the owner and owner's representative.

C. 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 of this section.

D. All Splashpad equipment and components shall be installed in conformance to the manufacturer's specifications and recommendations.

1.03 SUBMITTALS

A. Product Data: Manufacturer's descriptive literature for specified system including all components.

B. Show Drawings: Indicate component connection details and details of interface with adjacent construction.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

D. Manufacturer's Instructions: Include installation instructions for specified equipment, including each component.

E. Operation and Maintenance Data: Submit two sets of manufacturer's maintenance and operation instruction manuals with parts list for specified equipment. These manuals will illustrate the installation of the entire system and describe the start-up procedure and day-to-day operation of the system.

1.04 DELIVERY, STORAGE AND HANDLING

A. All aquatic play products and associated equipment must be properly wrapped and secured in place while in transport to the project site. Care shall be observed during offloading and handling to prevent excessive stress and abrasions.

B. At the site, the play products and associated equipment are to be stored in safe areas, out of the way of traffic and other construction activities, until the actual time of installation. If required, safety barricades or other like precautions must be taken for the protection of public and adjacent property.

C. Protective wrapping on the aquatic play features must be left in place until construction work for the Splashpad is complete.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. The contractor shall supply and install the following aquatic play features, activators, water distribution system and system controller as manufactured by Vortex Aquatic Structures or approved equal. Local Representative: Power Play (918) 728-9978.

2.02 PRODUCT WARRANTIES

A. A 25 Year Warranty on stainless steel tubing.

B. A 10 Year Warranty on structural stainless steel and weld workmanship.

C. A 5 Year Warranty on aluminum, brass and polymer panels.

D. A 2 Year Warranty on finishes, galvanized steel structures, plumbing components, mechanisms and hardware, and polymer.

E. A 1 Year Warranty on concrete components, electrical components, paint graphic and decal, polymer and composite.

2.03 PRODUCT CONSTRUCTION

A. **Play Products:** All aquatic play products installed above and below grade shall be manufactured from 304/304L stainless steel. The anchoring system and associated fastening hardware shall be manufactured from 304/304L stainless steel. Rigid centricast fiber reinforced (FRP) and/or molded fiberglass, PVC, filament wound tubing, Galvanized Steel, or Aluminum shall **not** be utilized for any above or below grade play product structures.

B. **Mounting and Assembly Hardware:** All hardware and anchoring systems shall be 304/304L or 316 stainless steel. All Play Products and Ground Spay systems shall include an integrated anchoring and leveling system facilitating installation and a flush surface finish. All exposed Play Product anchoring bases shall include a soft-touch elastomer cover that provides high impact, UV and chemical resistance while providing a soft, non-slip surface to absorb unintentional bumps from toes and feet. Exposed and accessible hardware shall be tamper resistant, requiring a special tool for removal to deter vandalism and theft.

C. **Spray nozzles, caps and heads:** Shall be manufactured from C360 brass, stainless steel or UHMWPE and shall use tamper resistant tools for installation and removal. PVC, Nylon, and Delrin™, shall not be utilized. All grade level play products are to be furnished with appropriate winterization caps.

D. **Painted Finish:** Shall be a polyester smooth glossy heat-cured powder coat that is UV and chemical resistant and suitable for public spaces. Airbrush graphics shall be applied over the powder coated base and shall be clear-coated for UV resistance and physical durability. Urethane

surface finish, smooth, textured and/or gel coat shall not be used for any of the play feature coatings.

E. **Polished Finish:** All polished stainless steel structures shall be passivated to inhibit corrosion.

F. **Material for Paneling, Signage, Water Deflection, and Toe Guards:** All Polyethylene, HDPE, Polyurethane, Elastomers, and Seeflow Polymers used for paneling, signage or water deflection shall be resistant to chlorinated water and be ultraviolet stabilized to inhibit sunlight fading.

G. **Safety & Craftsmanship:** All accessible edges shall be machined to a rounded finish. All welds shall be watertight, buffed smooth, or polished to a non-visible finish and factory pressure tested. Accessible nozzles and spray heads shall be recessed to ensure a completely safe play environment with no pinch points, head entrapments or protrusion hazards. All products shall be designed in accordance with ASTM F1487, ASTM F-2461 and CSA Z614-98 regulations for public playgrounds.

H. **Lexan Polymer:** The Lexan Polymer shall be specially selected for aquatic play products and shall have the following characteristics: translucent, highly resistant to shock and impact, vandalism and must be non-flammable. The polymer shall present dimensional stability a high resistance towards chemical products, ultra violets rays and be transparent presenting crystal clear surface throughout.

I. **Seeflow Polymer**: The Seeflow Polymer shall be specially selected for aquatic play products and shall have the following characteristics: translucent, highly resistant to shock and impact, vandalism and must be non-flammable. The polymer shall present dimensional stability a high resistance towards chemical products, ultra violets rays and be transparent presenting crystal clear surface throughout.

2.04 PRODUCT INSTALLATION

A. Install all equipment in accordance with shop drawings and manufacturer's printed installation instructions, comply with standards required by authorities having jurisdiction.

B. Safeswap Anchoring and Leveling Systems: The Stainless Steel Safeswap Anchoring System shall provide the ability to add/remove/interchange select play products without having to incur any additional infrastructure costs. The anchoring system shall have an integrated leveling system facilitating installation and a flush finished to the activity deck surface without any protruding bolts or hardware. The Play Product shall be fastened directly to the Safeswap Anchoring system. The dead and live loads shall be distributed onto the Safeswap Anchoring system flange plate. A neoprene sealing gasket shall provide a water tight seal between the play product flange and Safeswap flange. Mechanical fastening of the Play Products to the activity deck slab shall be prohibited unless used on elevation with Toe Guards.

C. Embedded Anchoring and leveling Systems: The anchoring system shall have an integrated leveling system facilitating installation, ensuring product is plumb and installed at the desired height.

D. When applicable, templates shall be supplied to facilitate the installation of embedded anchoring equipment.

E. All play products shall have electrical grounding studs incorporated into their associated anchoring equipment. All play products shall be grounded by the installer per local codes.

F. All installation conduit wiring including electrical supply panel, PVC connections, piping, elbows, tees, play product assembly if required and other items relating to the installation shall be supplied by the general contractor.

G. Drawings and Instructions: Product drawings and installation manuals shall be supplied by the manufacturer for ease of installation.

2.05 WATER FEATURES

A. **BULL FROG LOOP (VOR-7509):** shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 3½" and a wall thickness of 0.120". The loop shall be constructed of one continuous piece of tubing rolled to no less than a 80" (203cm) diameter with no joints or ripples. The loop structure shall have a detachable stainless steel panel with airbrushed graphics fastened to it. The SAFESWAP™ anchoring and leveling system shall be used. The overall height of the bullfrog shall be 78". Users can enjoy a multi directional misting from the Bull Frog Loop. The Bull Frog Loop shall have five (5) stainless steel nozzles. Each nozzle produces misty water effect. All nozzles are to be flush with the surface of the structural tubing to eliminate finger entrapment and protrusion hazards. The combined hydraulic requirements shall be 5-10 gpm @ 15-20 psi.

B. **CATTAIL (VOR-7538):** shall be constructed of bent 304/304L stainless steel structural tubing with an outside diameter of 3½" (8.9cm) and a wall thickness of 0.120" (3mm). The top extremity of the tail consist of one (1) translucent SEEFLOW™ polymer flower head. Four (4) nozzles are inserted around along the body post. All nozzle are to be flush with the surface to eliminate finger entrapment and protrusion hazards. The SAFESWAP™ anchoring and leveling system shall be used. The overall height of the play structure shall be 129" above ground. The four (4) nozzles on the post shall produce a soft stream spray effect. The combined hydraulic requirements shall be 2-4 gpm @ 5-6 psi.

C. **FLOWER No9 (VOR-7541):** shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 4½" and a wall thickness of .120", with two (2) side arm constructed of 3½" outside diameter 304/304L stainless steel structural tubing with wall thickness of .120". On each end of the tubes there is one dumping flower. The dumping flower shall consist of two translucent Seeflow polymer pieces glued to the dumping flower support. The dumping flower support shall have two bent square tubes and a 1.05" outside diameter aluminum pipe. The dumping flower shall be secured to the main post structure and the two arms with a stainless steel shaft and associated tamper-resistant hardware. The Safeswap anchoring and leveling system shall be used. The overall height shall be 153" above final grade, with a head clearance of 109". Users can enjoy the reflection of sunlight and try to predict when the dumping flower will fill and tip. The fill spout shall be constructed of 1.315" 304/304L stainless steel structural tubing. The water is dumped in the dumping flower. The combined hydraulic requirements shall be 15-75 gpm @ 5-10 psi.

D. **FROG No4 (VOR-7203):** shall be constructed of stainless steel structural tubing with an outside diameter of 4.50" and a wall thickness of 0.120". The structure shall be bent with no ripples or joints. The body of the Frog N°4 shall consist of two welded stainless steel domes with an outside diameter of 20" and a wall thickness of 0.120". The Frog N°4 shall consist of two (2) stainless steel sphere eyes with an outside diameter of 5" and a wall thickness of 0,120" and welded on the upper dome. The SAFESWAP™ anchoring and leveling system shall be used. The overall height of the Play Product shall be no less than 47". The Frog No4 shall have a 360 degree laminar water effect. The combined hydraulic requirements shall be 20-28 gpm @ 5-10 psi.

E. **JET STREAM No1 (VOR-7512):** shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 3". The lead-free brass spray cap and winter cap shall be threaded into the stainless steel spray head housing using a tamper-resistant tool. The Embedded anchoring and leveling system shall be used. The overall height of the Play Product shall be 5". The lead-free brass spray cap shall have a single ¼" spray hole projecting a vertical stream. The hydraulic requirements shall be 2-3 gpm @ 5-10 psi.

F. **ORBIT (SW) VOR-7398.2008:** shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 4½" and a wall thickness of .120". Each of the three (3) loops shall be constructed of one continuous piece of tubing rolled to no less than an 80" inch diameter with no joints or ripples, and shall include a handle sphere. Each Handle Sphere shall consist of two (2) half spheres constructed of high density, high impact aluminum, with a baked-on polyester powder coat finish. The Safeswap anchoring and leveling system shall be used. The overall height of the structure shall be 73". Each loop shall have five (5) stainless steel Rivozzles™. All Rivozzles are to be flush with the surface of the structural tubing to eliminate finger entrapment and protrusion hazards. All Rivozzle produce misty spray effect. The combined hydraulic requirements of all fifteen (15) Rivozzles™ shall be 15-30 gpm @ 10-25 psi.

G. **ROOSTER TAIL (VOR-0303):** shall be constructed of 304/304L stainless steel with an outside diameter of 4½". The brass spray cap and winter cap shall be fastened to the body using tamper-resistant fasteners. Tamper resistant winter caps shall be included. The anchoring system shall have an integrated levelling system to facilitate installation and provide for a plumb finished with the Splashpad surface. The spray head shall be interchangeable with other compatible SafeSwap Ground Sprays with similar spray zones. The overall height shall be 5". The spray cap shall have a thirteen (13) hole- pattern angled at 33° and 45° from the vertical divided into two (2) rows. The upper row shall consist of seven (7) holes equally spaced and angled at 33°. The lower row shall consist of six (6) holes equality spaced and angled at 45° to create a fan-like spray pattern. The hydraulic requirements shall be 10-15 gpm @ 5-10 psi or with low consumption nozzles 7-11 gpm @ 5-10 psi.

H. **SEAWEED No3 (VOR-7781):** shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 3½" (8.89cm) and a wall thickness of .120" (3mm). It shall have a curvy bend with no ripples or joints. The feature shall have eight (8) nozzles secured to the top of the post. The feature shall have three (3) SEEFLOW™ polymer panels having the shape of the seaweed. Three (3) sheet metal are welded to side of the post curves act as a support to the seaweed leaf panel. The panel are fastened to the supports with tamper resistant hardware. The SAFESWAP™ anchoring and leveling system shall be used. The above ground height of the structure shall be no less than 85". Eight (8) gentle water streams shall spray from the top of the curvy post. The combined hydraulic requirements shall be 4-7 gpm @ 5-10 psi.

I. **WATER TUNNEL No1 (VOR-304):** shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 1.9" and a wall thickness of .109". It shall have eight (8) equally spaced 3" diameter stainless steel spray head housings welded to it. Each spray head housing shall be fitted with a spray cap assembly consisting of a brass locking ring and an adjustable brass spray sphere. All nozzle systems shall be free of finger entrapment hazards. The Embedded anchoring and leveling system shall be used. The overall height shall be 12.2". The water effect from each spray head shall produce a single soft stream adjustable from the vertical position to a maximum of 25° from vertical. Rotating the adjustable spray nozzle 90° from the vertical position sets the spray head to its water-

tight winterized position. The combined hydraulic requirements of all eight (8) spray nozzles shall be 25-40 gpm @ 5-10 psi or with low consumption nozzles 16-24 gpm @ 5-10 psi.

J. **WATER TUNNEL No3 (VOR-7641):** shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 2⅞" and a wall thickness of .120". The snake-shaped bending shall be fabricated from one continuous bending with no ripples or joints. It shall have eight (8) 3" diameter stainless steel spray head housings welded to it. The Embedded anchoring and leveling system shall be used. The Water Tunnel shall span 86" in length and 44" in width. The double-sided Water Tunnel encourages active play with water arcing out on both sides of each ground spray. Users can run up and down under both sides of the water arches. Each spray head housing shall be fitted with a spray cap assembly consisting of a brass locking ring and an adjustable brass spray sphere. The water effect from each spray head shall produce a double soft stream, each positioned at 30° from vertical. All nozzle systems shall be free of finger entrapment hazards. Rotating the adjustable spray nozzle 90° from the vertical position sets the spray head to the water-tight winterized position. The combined hydraulic requirements of all eight (8) spray nozzles shall be 30-50 gpm @ 5-10 psi or with low consumption nozzles 16-24 gpm @ 5-10 psi.

2.05 WATER DISTRIBUTION SYSTEM

A. **SUBTERRANEAN COMMAND CENTER (VOR-16XX):** The Subterranean Command Center shall be a pre-fabricated water distribution system containing piping, valves and electrical wiring. It shall be factory assembled; water pressure tested, and shall be delivered from the Splashpad equipment manufactures facility. It shall be equipped with threaded connections for the water inlet and slip-on for water outlets. The solenoid valves shall be pre-wired to the controller when the controller is located in the command center. Should the controller be located remotely, Vortex shall supply 10 feet of wire for the controller to each of the solenoid valves; the installer shall supply additional wire if required. Wire connections from the controller to each of the solenoid valves shall be by the installer. The controller shall be grounded per local codes by the installer. The installer shall provide the plumbing equipment required from the water source to the water inlet or backflow device and pressure regulator if so configured. The installer shall provide the plumbing equipment required from the water outlets to the Splashpad water features. The Subterranean Command Center shall consist of aluminum reinforced frame and access hatch suitable for use in public spaces. The side walls shall be paneled with ABS sheets predrilled for all applicable water line inlets and outlets. The access hatch shall be constructed of 1/4" thick, reinforced; powder coat painted aluminum checker plate, and shall be lockable using a standard padlock. For equipment servicing, an integrated corrosion resistant step down pedestal/seat shall be included. All hardware shall be stainless steel. If called out on plans, a 2" backflow preventer and 2" pressure reducing valve shall be included and installed in the command center. The Water Distribution Manifold shall be constructed of 3 ½" outside diameter stainless steel structural tubing with a power coat painted finish. Each water distribution port shall be a 1-1/2" NPT connection. The manifold shall be equipped with a pressure gauge. All welded joints shall be watertight and pressure tested to 150 psi. There shall be one (1) solenoid valve installed on each of the water distribution ports for the water features. They shall be a normally closed 24 VAC 50/60 cycle solenoid actuated globe/angle pattern design. The valve pressure rating shall not be less than 150 psi. The valve body and bonnet shall be constructed of PVC with stainless steel fasteners. The valve shall have a manual override capability (manual open/close control). It shall house a fully encapsulated, one-piece solenoid. Each Solenoid valve shall have in

integrated flow control adjustment valve stem for fine tuning water spray effects. All piping and fittings shall be at least schedule 40 PVC. All factory-assembled components, fitting and connections shall be water pressure tested prior to delivery. All electrical wiring shall be # 14 AWG with a 600V rating. All electrical connections, enclosures, and conduit shall be NEMA 4x watertight.

B. **SMARTFLOW LOGICS™ SPLASHPAD CONTROLLER (VOR-0718.6XXX):** The Equipment Enclosure shall be made from corrosion resistant hot compression molded fiberglass reinforced polyester which do not contain halogens. The enclosure shall be capable of withstanding continuous temperatures from -58°F (-50°C) up to 302° F (150° C) and shall provide indirect electrical contact protection for equipment and operators. Enclosures shall be UL listed per UL Standard 508 for NEMA 3, 3R, 4, 4X, 12 and 13; CSA Certified per Standard C22.2-0, 0.4, 0.7, 0.6, 94 Type 3, 3R, 4, 4X, 12 and 13.The Splashpad programmable logic controller shall be sized according to the number of outputs it is required to control. The programmable logic controller shall be factory programmed with a spray sequence designed according to the requirements of the project. It shall have the flexibility to user modify the sequences using a DataKey memory stick. A battery backup shall protect the system memory and time setting. A 24hr/7day user programmable time switch shall allow the user to set the operational hours of the facility. The time switch shall have the ability to be programmed with two different operating periods for each day of the week or a Weekday and Weekend periods. The operating system shall be supplied with a membrane user interface with controls for each output, activation device(s), and time switch. The 4 lines 20 characters display screen shall be visible to 3ft, with a 45 degree viewing angle and contrast adjustment. The operating system shall be housed in a corrosion resistant NEMA 4X rated enclosure. The operating system shall have the capacity to receive signals from activation devices operating on 24VDC. The operating system shall have the capacity to operate based on a programmed sequence or based on a randomly generated sequence. In random mode each touch of the activator will generate a new unique sequence. The operating system shall have the capacity to operate in five different languages which can be changed on site by the user. Languages available: English, French, Spanish, German and Italian. The operating system shall have the capacity to operate a Rain Diverter Valve to prevent rain water to go into the sewer network when the Splashpad is not in function. The operating system shall have the ability to be upgraded using DataKey memory stick. The operating system shall have the option of using a membrane keypad locking mechanism, requiring a user configurable password to access the Controller functions. The operating system shall have the ability to automatically purge all water lines based on the user selected time and duration (i.e. every day at 5 am). It shall also, be configured to purge all lines after a user defined period of inactivity (i.e. after 4 hours of inactivity). All main power electrical connections to the Splashpad Controller are to be performed per local codes. Product drawings and installation manuals shall be supplied by the manufacturer for ease of installation.

C. **BOLLARD ACTIVATOR No3 (VOR-611):** shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 4½" and a wall thickness of ⅛". The activator shall have no moving parts and run on a low voltage electrical supply. A 14 AWG 2 wire conductor is to be used for the electrical connection. The activation cap shall consist of a high impact-resistant protective cap and a piezo switch. The protective cap shall be constructed of polished stainless steel and shall be secured in place using tamper-resistant fasteners. The Bollard Activator shall have an overall height of 3'3" above the final grade. The Bollard

Activator shall be the direct interface between the users of the aquatic play area and the aquatic play products. The pre-programmed sequences of the aquatic play products shall be activated only when the touch-activated sensor cap on the Bollard Activator is touched by the user.

2.06 UTILITY LINES AND EQUIPMENT

A. Water Supply Piping and Sleeving: Schedule 80 PVC pipe and fittings, per Drawings. Provide PEX piping for all water piping under pavement.

B. Backflow Preventer: Install as specified on Drawings with City provided enclosure to be installed by contractor and complying with City of Tulsa codes.

C. Electrical Supply: As specified and shown on Drawings.

2.07 WATER PLAYGROUND DRAINS

A. The contractor shall provide and install water playground drains as indicated on the construction documents.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that required utilities are in correct location and are of correct capacities for specified products.

B. Verify equipment rough-in before proceeding with work.

3.02 INTERFACE WITH OTHER WORK

A. Coordinate with other trades for proper installation of plumbing, electrical services and concrete work.

B. Verify equipment rough-in before proceeding with work.

3.03 STARTING EQUIPMENT AND SYSTEMS

A. Adjust for proper operation within manufacturer's published tolerances.

B. Upon completion, the general contractor/installer shall provide the owner/operator adequate training on facility operations and maintenance. The contractor may request that the equipment manufacturer and/or manufacturer's local representative provide on-site start-up and training for the owner/operator.

3.04 UTILITY CONNECTIONS

A. Connect to electrical supply per Drawings and provide new electrical line to controller / backflow preventer to be installed in Schedule 40 PVC conduit per Drawings. Connect to water supply and extend new PEX line to backflow preventer / equipment room as shown. Install pressure regulating valve and backflow preventer in hotbox enclosure per Drawings.

B. Install controller in location shown on Drawings. Contractor to install controller in City provided enclosure box.

3.05 EQUIPMENT INSTALLATION

A. Closely coordinate equipment installation with concrete water playground layout and installation.

B. Receive approval from Architect of subbase preparation and layout of water playground slab and location of all equipment / nozzles. Install water line piping and electrical supply lines per Drawings with sleeves as shown.

C. Before construction of water playground slab per Specification 32 1316, construct reinforced concrete footings for water playground equipment, per details on drawing, with anchor bolts imbedded as shown.

D. Install all equipment and water jet nozzles per manufacturer's directions and per Drawings, with water and electrical connections, to be fully operational. Wrap or otherwise protect above ground equipment as needed to avoid damage from other construction or slab staining operations.

E. Coordinate with City of Tulsa Parks Department Personnel and water play equipment manufacturer for programming of controller / computer control chip. Programming of control chip and controller shall be performed after installation. Contractor to include controller manufacturers programming fee. Adjust the system, including pressure regulating valve, as required for proper operation.

F. Once the water playground is complete and fully functional / adjusted, notify City of Tulsa for inspection and approval. Make requested repairs and repeat inspection process as needed. Provide a thorough training session to Owner's maintenance personnel, covering the equipment installation and operation in detail.

G. Warranty: Provide 12-month warranty on materials and workmanship for the water playground installation and operation. For defective materials and / or workmanship, make repairs at no additional cost to City of Tulsa. Provide warranties for specific water play equipment products and finishes as described previously in this specification.

3.06 RECORD DRAWING

A. Inside controller, include a zone chart / piping schematic that clearly indicates equipment that operates with each valve. Place chart (11 x 17 size) in plastic sleeve mounted to controller door.

END OF SECTION

SECTION 12 3616 - STAINLESS STEEL COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless steel countertops and backsplashes.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples for Verification: For the following products:
1. Countertop material, 6 inches square.

1.3 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.4 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 STAINLESS STEEL COUNTERTOPS

A. Stainless-Steel Countertops:

1. Description: Flat countertops configured as indicated.

a. Tops: Stainless steel, Type 304, 0.078 inch thick, reinforced and sound deadened.

1) Back Splash: Manufacturer's standard height.
2) Edge: Bullnose on front edge, and sides.

B. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

2.2 COUNTERTOP MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, type as indicated.

1. Stainless-Steel Finish: Directional satin finish, No. 4.

B. Adhesives: Adhesives shall not contain urea formaldehyde.

2.3 FINISHES

A. Stainless-Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet.

B. Install countertops level and plumb, according to manufacturer's written instructions.

C. Complete assembly where field assembly is required.

1. Provide closed butt and contact joints that do not require a filler.
2. Grind field welds on stainless-steel equipment until smooth and polish to match adjacent finish.

D. Install countertops with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.

E. Install joint sealant in joints between stainless steel and abutting surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

3.2 CLEANING AND PROTECTING

A. After completing installation of countertops, repair damaged finishes.

B. Clean countertops as required to produce ready-for-use condition.

C. Protect countertops from damage during remainder of the construction period.

END OF SECTION 12 3616

SECTION 12 9300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the installation of site furnishings that includes benches, picnic tables, bicycle racks, and as shown on Drawings.

1.2 QUALITY ASSURANCE

A. Notify the Owner of site furnishings being delivered to the project site. The Owner shall have the option to inspect all site furnishings before installation. Products that are unacceptable to the Owner shall be replaced to meet requirements of this specification.

1.3 SUBMITTALS

A. Literature: Technical data and installation instructions for all site furnishings.

B. Samples: Provide digital finish color samples of all furnishings. Receive approval of colors for all items prior to ordering products.

C. Maintenance and clean up: Provide manufacturer's instructions for cleaning and maintenance.

1.4 DELIVERY AND STORAGE

A. Site furnishings shall be delivered to the project site in their original unopened containers, bearing labels clearly identifying the manufacturer's name. Storage of materials shall be subject to approval by the Owner and General Contractor.

1.5 JOB CONDITIONS

A. Existing conditions: Examine work to determine that paving and other necessary work is complete and satisfactory.

B. Protection: Protect site furnishings and adjacent work against damage during construction of the project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Picnic Tables: Refer to Site Furnishings Schedule on Drawings for manufacturer, model number, and color.

B. Bench: Refer to Site Furnishings Schedule on Drawings for manufacturer, model number, and color.

C. Bicycle Rack: Refer to Site Furnishings Schedule on Drawings for manufacturer, model number, and color.

D. Trash Receptacle anchoring post: Refer to Drawings for details and notes

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine installation areas. Field verify the location of all site furnishings. Receive approval from Owner's Representative prior to installation of furnishings.

B. By beginning installation, the contractor accepts existing site conditions.

3.2 INSTALLATION

A. Install components plumb and level, and accurate in location, alignment and elevation. Fit exposed connections accurately together to form tight joints.

B. For all furnishings, install according to manufacturer's directions and according to installation details on Drawings. Closely coordinate with other trades / site construction activities as required.

C. Mount all surface mounted furnishings with vandal resistant hardware.

3.3 PROTECTION

A. Protect all site furnishings from construction activities with temporary protective coverings, as needed.

3.4 CLEAN-UP

A. Clean-up site furnishings as required and in accordance with manufacturer's recommendations.

END OF SECTION 12 9300

SECTION 13 1113 - POOL GENERAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Project administrative requirements that relate to Division 13 11 Pools.

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

B. The following contain requirements that relate in Division 13 11:

1. Mechanical/Electrical/Equipment Coordination: General Conditions, Supplementary General Conditions and Division 01 General Requirements
2. Earth Work and Pool Excavation: Division 31
3. Concrete Deck Work: Division 03
4. Mechanical: Plumbing Systems - Division 22, HVAC Systems and Equipment - Division 23
5. Electrical: Division 26

C. Applicable requirements of the following Codes and Standards apply to Work in Division 13 11:

1. National Spa and Pool Institute (NSPI)
   a. Minimum Standard for Public Swimming Pools
2. National Electrical Code (NEC)
3. National Sanitation Foundation (NSF): Seal of Approval Program
4. American Society for Testing and Materials (ASTM): Specifications referenced herein
5. Governmental Health and Building Codes
6. ADA Accessibility Guidelines for Buildings and Facilities
7. American National Standards Institute

1.3 REFERENCES

A. Refer to individual Division 13 11 sections.

1.4 DESCRIPTION OF WORK

A. Work of Division 13 11 includes, but is not limited to, the following:

1. Layout of all pool(s) and pool related work required under Division 13 11.
2. Project benchmarks and control points.
3. Excavation and stone fill as required for pool tank structure and pipe trenching. Refer to Division 01 and 31 for special conditions.
4. Pool vessels, as detailed on Contract Drawings and Shop Drawings.
5. Pool mechanical systems, including piping, recirculation system, filtration system, activity mechanical systems and water chemical treatment system.
6. Heating system for swimming pool. Coordinate venting and interlocking for pool heater(s) with HVAC Contractor.
7. Waterslide and water activity mechanical systems including all piping.
8. Pool subsurface water monitoring system – includes perforated piping (with silt sleeve) under pool floor slab and riser pipe to deck elevation. Refer to drawings if applicable.
9. Interior pool finishes.
10. Pool deck equipment and accessory equipment shown and/or specified, including required anchors embedded within the pool deck and coordination with Deck Contractor.

11. Coordination of all electrical interlocks for pool and pool related equipment.
12. Miscellaneous pool testing, safety and control equipment.
13. Low voltage wiring for pool and pool related equipment is installed and connected by the Swimming Pool Contractor unless required otherwise by code. Where code requires that low voltage wiring is installed by a licensed electrical contractor, low voltage wiring is specified in Electrical Documents.

B. Definitions

1. The term "pool" as used in Division 13 11 shall refer to the following:
   a. Pool A – Leisure Pool
2. The term "concrete" as used in Division 13 11 refers to concrete for swimming pool construction only.
3. The term "Architect/Engineer" as used in Division 13 11 refers to the swimming pool designer only.
4. The term "Contractor" as used in Division 13 11 refers to the swimming pool contractor only.
5. The term "Low Voltage Wiring" as used in Division 13 11 includes wiring <= 24V. All Low Voltage Wiring is Provided with the Equipment. Low voltage wiring is shown in Low Voltage Wiring Diagram included in the pool drawings except where specified by Electrical Consultant.
6. The term "Control Wiring" as used in Division 13 11 refers to connections from individual equipment components to the Building Management System (BMS).

C. Applicable Code Permit and Inspection Responsibilities.

1. State and/or County Health Department permit fees by Owner.
2. Local Departments of Health inspection fees by Contractor.
3. Other permits/fees required paid by Contractor.
4. Scheduling of Required Inspections – Contractor
5. Documentation and Submission of accepted modifications to approved plans to Permit Authorities – Contractor.

D. Related Work Not in Division 13 11 Specified Elsewhere

1. Pool deck construction, including finishes, sealants, and drains.
2. Potable water or fresh water: Fresh water connection to auto fill and waste water connections (see Contract Drawings).
3. Pool electrical work: Electrical connections shall be by the General Construction Contract Electrical Sub-Contractor. The Pool Contractor shall provide the filter pumps, motors, solenoids, relays, water level probes (with housing), motorized valves, etc., as shown on Contract Drawings and required by pool systems equipment manufacturer. The Electrical Contractor shall install and wire electrical equipment furnished by the Pool Contractor and shall provide motor starters and disconnect switches as indicated or required by Codes. The Electrical Contractor shall provide grounding and bonding per NEC Article 680.
4. Control Wiring for all electrical and HVAC equipment shall be by the control system sub-contractor.
5. Heating system for pools, heater by the Pool Contractor; venting and controls by Division 23.

1.5 QUALITY ASSURANCE

A. Qualifications of Pool Contractor:

1. Work of Division 13 11 shall be performed by a Pool Contractor who has a minimum of five (5) projects with a proven five (5) year record of competence and experience in the construction of similar facilities of this size and complexity.
2. **Pool Contractor prequalification is required prior to bid. This must be received by the Architect fourteen (14) days prior to the bid date on the appropriate AIA form. (AIA A305)**

3. Pool Contractor shall meet all Local and State Certifications and License requirements prior to bidding. Copies of the required Certificates and Licenses shall be made available upon request.
4. List of approved Pool Contractors (Note: Pool Contractors on list must still prove that they meet the qualifications of this section prior to bid.)
   a. **Sunbelt Pools**, 10555 Plano Road, Dallas, TX 75238; T: 214-722-5079
   b. **Westport Pools**, 156 Weldon Parkway St., St. Louis, MO 63043; T: 314-743-4809
   c. **Pool Art**, 2255 Southview Dr. Ste. 100, Wylie, TX 75098; T: 469-609-0200
   d. **Blue Haven Pools and Spas**, 200 NE 150th St., Edmond, OK 73013; T: 405-844-7500
   e. **Premier Pools**, 4503 E 143rd Pl S, Bixby, OK 74008; T: 918-829-3254
   f. **Aqua Design Systems**, 207-A Jeff Davis Place, Fayetteville, GA 30214; T: 877-816-7609
   g. **Burton Pools & Spas**, 6121 Zero St., Fort Smith, AR 72903; T: 479-648-3483
   h. **Designer Pools of Tulsa**, 7878 S. 283rd E. Ave., Broken Arrow, OK 74014; T: 918-280-9619
   i. **Pool Creations, Inc.**, 16990 E. Pine St., Tulsa, OK 74116; T: 918-289-0779

B. Performance Criteria: Certain sections of Division 13 11 contain performance criteria rather than product descriptions. It shall be the obligation of the Pool Contractor to ensure that all criteria are satisfied and the burden of proof of conformance shall rest with the Pool Contractor. The Architect/Engineer shall require complete calculations, past performance records and, if required, inspection trips of similar facilities to substantiate conformance with these criteria. The Architect/Engineer shall be sole judge of conformance, and the Pool Contractor is cautioned that he will be required to provide a finished product meeting all stated criteria and meeting or exceeding Department of Public Health requirements.

C. All work of Division 13 11 shall be performed by the qualified Pool Contractor or a Subcontractor to the qualified Pool Contractor unless otherwise pre-approved in writing by the Architect/Engineer. A representative of the Pool Contractor shall oversee work subcontracted by the Pool Contractor.

D. The following shall be performed during construction of the project.

1. Refer to General Conditions, Division 01, and other Division 13 11 sections for further requirements.

1.6 SUBMITTALS

A. Submittals Required

1. Refer to General Conditions, Division 01, and individual Division 13 11 sections for number required.
2. The Contractor shall submit for approval to the Architect/Engineer complete lists, including descriptions, catalogs, product cut sheets, etc., and where applicable dimensioned shop drawings of all material, fixtures and equipment to be furnished and installed as part of Division 13 11.
3. Submittals shall adequately and completely describe the equipment, including where necessary or requested complete construction and installation dimensions, complete capacity and performance data, all accessories and auxiliary equipment and all pertinent details of manufacture.
4. Submittals shall be provided complete and bound in a 3-ring binder or as pre-approved by Architect/Engineer.
   a. Contractor's Option – In lieu of paper copies indicated above, submit in Adobe PDF electronic file format via email file size (10 MB max.). Create PDFs at native size and right-side up; illegible, partial, unlabeled or unorganized submittal sections will be returned rejected. Contractor shall make their own copies from the original returned by the Architect.

B. Product Data: Provide manufacturer's/installer's written installation instructions.

C. Shop Drawings

1. The drawings accompanying this Specification are diagrammatic in nature and show the general arrangement of all equipment, piping, ductwork, services, etc. Because of the small scale of the drawings, it is not possible to show all offsets, fittings and accessories that may be required. The Contractor shall carefully investigate the structural and finish conditions of his work and shall arrange such work accordingly; furnishing all fittings, pipe and accessories that may be required to meet such conditions. Where conditions necessitate a rearrangement, the Contractor shall obtain the Architect/Engineer's approval.
2. Shop drawings for equipment shall be submitted, and Engineer's review of shop drawing shall be obtained before proceeding with fabrication. Shop drawings shall not be "doctored" reproductions of Architect/Engineer's drawings.

D. Samples: Submit samples of materials, finishes, and trim as requested by the Architect/Engineer.

E. Schedule of Values

1. Provide Architect/Engineer with a copy of the Schedule of Values developed for this project relevant to Division 13 11 for approval.

F. Valve Charts: Submit two (2) copies of valve charts for each piping system, consisting of Isometric Drawings or piping layouts showing and identifying each valve and describing its function to the Architect/Engineer for approval.

1. Upon completion of the Work, one (1) copy of each chart sealed to rigid backboard with clear lacquer placed under glass and framed, shall be hung in a conspicuous location in the equipment room.

G. Furnish to the Architect/Engineer the following:

1. Refer to individual Division 13 11 sections for additional requirements.
2. Submittals
   a. Shotcrete Nozzle Man Qualifications and Certifications
   b. Pool Finish Experience/Qualification Requirements
   c. Concrete Mix Design
   d. Non-shrink Grouts
   e. PVC and Pre-formed Plastic Adhesive Waterstop
   f. Expansion/Construction Joint Materials
   g. Caulking/Sealants
   h. Pumps and Strainers
   i. Heater(s)
   j. Chemical Controller(s)
   k. Chemical Feeders
   l. Bulk Chemical Storage Tanks
   m. CO2 Feeders, Heater, Fill Box, Bulk Tank, and Alarm
   n. Valves
   o. Gauges
   p. Flow Meters
   q. Thermometers
   r. Pool Water Test Kit
   s. Inlets
   t. Grating
   u. Pre-fabricated Submerged Outlets
   v. Under Water Pool Lighting
   w. Deck Equipment

x. Safety Equipment
y. Maintenance Equipment
z. Submersible Pump for draining observation well or pool
aa. Piping Materials (pipe, fittings, solvents, cements)
bb. Wall Sleeves and Seals for Piping
cc. Tile Setting Materials and Joint Fillers

3. Shop Drawings
   a. Reinforcing Steel
   b. Water Activities
   c. Filters
   d. Stainless Steel Gutter
   e. Precast Pool Coping Stone
   f. UV Disinfection System
   g. Concrete Pump Pit & Surge Tank Penetration Drawings
4. Test Results
   a. Water Treatment Analysis
   b. Compaction
   c. Piping Pressure Testing
5. Samples
   a. Special Aggregate – Factory and Field Applied
   b. Tile
   c. Gratings
6. Guarantees/Warranties
   a. Standard 1-Year
   b. Standard 5-Year on Quartz Aggregate Finish
   c. Standard 2-Year on Pool Finish Application
   d. Special Equipment – Standard Manufacturer's Warranty
   e. Future 3-Days of Instruction and Operational Checkout
7. Close Out Documents
   a. O & M Manuals
   b. Record Drawings
   c. Owner's Certification of Instruction
   d. Extra Materials

1.7 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

B. Along with the Shop Drawings, the Contractor shall submit, in duplicate, a certificate properly attested, stating the material, equipment, and construction comply with the requirements of the Contract Documents, for all equipment and materials proposed as a Substitute for the specified equipment and materials.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Refer to General Requirements and Division 01 of the Specifications for additional requirements.

B. Deliver all materials and equipment to the work site in original packages, fully identified with manufacturer's label. Store off ground and protect from weather with a suitable covering.

C. Protect plastic pipe from exposure to chemicals (aromatic hydrocarbons, halogenated hydrocarbons and other esters and keytones) that might attack the material. Protect all pipes from mechanical damage and long exposure to sunlight during storage.

1.9 WARRANTIES

A. Warranty: Provide one (1) year warranty covering all pool workmanship, materials, and equipment. Refer to General Requirements and Division 01 of the Specifications for additional requirements.

B. All standard manufacturer's warranties shall apply to all equipment and products provided by this Contractor.

PART 2 - PRODUCTS

2.1 POOL EQUIPMENT

A. Refer to pool documents for references of pool equipment, details, and other items to be provided by the pool contractor.

B. Provide submersible pump for observation well and draining pool as needed:
   1. Pentair Stainless Steel Submersible Pool Service Pump, Model PCD-1000, 3/4 HP, 115V, 1Ø, 6.4 FLA, (15 A). Coordinate service around pool for power.

PART 3 - EXECUTION

3.1 EQUIPMENT BASES AND SUPPORTS

A. Provide for major equipment, reinforced concrete housekeeping bases poured directly on structural floor slabs (or as required by equipment manufacturer) 4 inches thick minimum; unless noted otherwise on plans, extended 4 inches beyond machinery bedplates. Provide templates, anchor bolts, vibration isolators, and accessories required for mounting and anchoring equipment. Anchorage system shall be in accordance with the equipment manufacturer's specifications and local code requirements. Consult with equipment manufacturer for length and installation of anchor bolts.

3.2 CLEAN UP AND PROTECTION

A. After work of Division 1311 has been completed, clean up work areas and remove all equipment, excess materials, and debris. Protect pool from damage until substantial completion. Remove and replace equipment and finishes that are chipped, cracked, abraded, improperly adhered, or otherwise damaged.

B. At turnover to Owner, Contractor shall be responsible for, but not limited to, the following:
   1. Vacuuming and cleaning all pool floors, steps and walls.
   2. Cleaning all depth marker tiles, pool tile and gutter grating.
   3. Cleaning and waxing of all pool deck equipment, water features and stainless steel products per Manufacturer's instructions.
   4. See also Division 01 Specification requirements.

END OF SECTION 13 1113

SECTION 13 1114 - POOL START-UP, MAINTENANCE & OPERATIONS TRAINING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pool start-up and chemical balancing of water.

B. Training of the Owner's personnel in pool operations procedures.

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 DESCRIPTION OF WORK

A. Water treatment and balancing.

B. Operations and maintenance instruction and manuals.

1.4 SUBMITTALS

A. Operations and Maintenance (O&M) Manual

1. Pool Contractor shall deliver to the Architect/Engineer water sample location, analysis test results, SI calculation, and chemical adjustment calculations as required per Part 3.02.
2. Pool Contractor shall deliver to the Architect/Engineer, bound together in a three-ring binder a complete manual, four (4) complete sets of operating and maintenance instructions for the swimming pool structure(s), finishes, and all component equipment. O&M Manual shall include, but is not limited to, the following:
   a. Table of contents.
   b. All equipment cut sheets.
   c. Accurate parts lists.
   d. Pool start-up, emptying, and winterization instructions.
   e. Pool cleaning instructions.
   f. Pool maintenance requirements divided into the following:
      (a) Daily
      (b) Weekly
      (c) Monthly
      (d) Seasonally
      (e) Annually
   g. Narrative on the pool operation through all sequences.
   h. A DVD of complete start-up and shut-down procedures and training session.
   i. Trouble shooting information and procedures.
   j. A schematic of piping as installed.
   k. Valve charts for each piping system, consisting of isometric drawings or piping layouts showing and identifying each valve and describing its function.
   l. Copy of Measurement Certification of Permanent Racing Course
   m. Record Drawings
   n. Warranties

PART 2 - MATERIALS

2.1 NOT USED

PART 3 - EXECUTION

3.1 OPERATIONS & MAINTENANCE INSTRUCTION

A. Provide an experienced swimming pool operator-instructor (NSPF Certified Pool Operator, or equivalent certification) for a period of not less than three (3) days (two (2) full days operations and start-up, and one (1) full day shut-down assistance) after the pool has been filled and initially placed into operation.

1. During this period, the Owner's designated representative(s) shall be thoroughly instructed in all phases of the pool's operation, including start-up, emptying, and winterizing procedures.
2. Prior to this instructor leaving the Site, instructor shall obtain written certification from the Owner's designated representative acknowledging that the instruction period has been completed and all necessary operating information provided.

B. Include the cost of three (3) additional days of instruction and operational checkout/verification by an experienced swimming pool operator-instructor during the first year's operation. Written reports of each of these three (3) visits outlining the pool's operation, competence and performance of the pool's operating personnel and other pertinent comments shall be submitted to the Owner and Architect/Engineer within one week after each visit.

C. Provide a DVD documenting training and operational requirements, including start-up, emptying, and winterizing procedures.

D. In addition to initial pool instruction listed, the Pool Contractor shall perform the first season pool closing (winterizing) and the following season pool start-up, including all labor and materials required.

3.2 WATER TREATMENT AND BALANCING

A. Obtain a chemical analysis of the source/pool make-up water supply from a location as close as possible to the actual pool autofill. Conduct laboratory testing for the following parameters:

1. Total Alkalinity [Parts per Million (ppm)]
2. pH
3. Calcium Hardness [ppm]
4. Free Chlorine [ppm] & Combined Chlorine [ppm]
5. Total Dissolved Solids (TDS) [ppm]
6. Iron (Must test to a lower detectable limit of <=0.05 ppm)
7. Manganese (Must test to a lower detectable limit of <=0.01 ppm)
8. Copper (Must test to a lower detectable limit of <=0.1 ppm)

B. The following are ideal ranges for the water analysis test results. If results fall outside these ranges the Contractor shall make chemical adjustments to the water during the pool filling process until values within the ideal ranges are obtained.

1. Total Alkalinity: 80-100 ppm (for high pH disinfectants) 100-120 ppm (for low pH disinfectants)
2. pH: 7.4-7.6
3. Calcium Hardness: 200-400 ppm (Pools), 150-250 ppm (Spas)
4. Free Chlorine: 2.0-4.0 ppm & Combined Chlorine: 0.0-0.2 ppm
5. Total Dissolved Solids: Acceptable Start-up Range is not applicable (Maintain future TDS levels to within 1200 ppm above the start-up measurement)
6. Temperature: Ideal Range is +-2 degrees F from the desired pool operating water temperature.

7. Iron: <=0.05 ppm
8. Manganese: <=0.01 ppm
9. Copper: <=0.1 ppm

C. Contractor shall calculate the Langlier Saturation Index (LSI) using values from the water analysis. The formula for LSI is shown below. Calculations may be made easier using through use of Orenda Technologies Mobil App, or a similar calculator. The LSI values shall fall within an acceptable "balanced" range of -0.3 to +0.3. If the LSI is outside this range OR test values are outside the ideal range listed above, the Pool Contractor shall prepare to add chemicals to the pool water volume as required until all parameters are within the ideal ranges previously listed, and the LSI is considered "balanced", Contractor is responsible for calculating required chemical additions and for adding all adjustment chemicals up until the time of project completion. Owner is responsible for providing the chemicals.

LSI Equation:
(pH) + (Temperature °F) + (Calcium Hardness) + [(Total Alkalinity) – (CYA correction factor @ current pH)] – (TDS factor) = LSI

Equivalent Factors - Langelier Saturation Index (LSI)

Temperature	Temperature	Calcium	Calcium	Alkalinity	Alkalinity	Cyanuric	Cyanurate	Total	TDS Factor
32	0.0	5	0.3	5	0.7	pH	Factor	< 1000 ppm	12.10
37	0.1	25	1.0	25	1.4	7.0	0.23	1000 ppm	12.19
46	0.2	50	1.3	50	1.7	7.2	0.27	2000 ppm	12.29
53	0.3	75	1.5	75	1.9	7.4	0.31	3000 ppm	12.35
60	0.4	100	1.6	100	2.0	7.6	0.33	4000 ppm	12.41
66	0.5	150	1.8	150	2.2	7.8	0.35		
76	0.6	200	1.9	200	2.3	8.0	0.36		
84	0.7	300	2.1	300	2.5	Note: Only use if CYA is used in your pool. Only applies to >7.0pH. If so, select correction factor based on pool pH.		Note: most calculators assume 12.1 for under 1000ppm, or 12.2 for anything over 1000.	
94	0.8	400	2.2	500	2.6				
105	0.9	800	2.5	800	2.9				

D. Contractor shall provide a submittal to the Engineer/Architect after receiving the water analysis. Submittal shall include the following:

1. Water sample location and analysis test results,
2. SI Calculation,
3. Chemical adjustment calculations indicating the following:
   a. Pool Volume
   b. Chemical Parameters requiring adjustment
   c. Chemicals required to make the adjustments
   d. Calculations showing amounts of each chemical addition that is required

E. Contractor shall provide list of required balancing chemicals with quantities to the Owner for purchase immediately after receiving the approved submittal from the Engineer/Architect. Owner shall be responsible for providing the pool fill water and chemicals to the Contractor for use during the pool fill and start-up process.

F. Contractor shall make chemical adjustments to the pool water during the pool startup process based on calculations provided in the approved submittal. It is critical to keep the pool water clean and balanced during the initial fill and while the pool plaster finish is curing. Follow all recommendations of the National Pool Plasterers Council for initial adjustments required during the plaster cure time. See additional requirements in Pool Finish Specification Section/s.

G. Stabilize pool water to within a range of 5 to 15 ppm maximum of cyanuric acid.

H. Heat pool water to within 5 degrees Fahrenheit of the desired pool operating temperature. Once this temperature is attained, the Pool Contractor shall enter the chemical controller settings for all chemical parameters. Do not enter chemical controller settings prior to reaching the desired pool operating temperature range.

END OF SECTION 13 1114

SECTION 13 1118 - POOL CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section specifies cast-in-place and shotcrete concrete for swimming pools and related structures, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. Cast-in-place reinforced concrete shall be used for pool floor and wall construction. Shotcrete construction can be used as an alternate to cast-in-place concrete for pool wall construction only if contractor's qualifications have been pre-approved by the Architect/Engineer. This Section of the Specifications covers the furnishings of all labor, materials, tools, equipment, and the performance of all Work and services necessary or incidental to furnish and place all concrete necessary as shown on the Drawings and as specified, in accordance with the provisions of the Contract Documents, and completely coordinated with the Work of all other trades.

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 REFERENCES

A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.

1. ACI-318 – Building Code Requirements for Reinforced Concrete
2. ASTM C172 – Methods for Sampling Fresh Concrete
3. ASTM C31 – Making and Curing Concrete Test Specimens in the Field
4. ASTM C39 – Compressive Strength of Cylindrical Concrete Specimens
5. ASTM C143 – Standard Method of Test for Slump of Portland Cement Concrete
6. ASTM C231 – Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method
7. ASTM C260 – Specification for Air-Entraining Admixtures for Concrete
8. ASTM C494 – Specification for Chemical Admixture for Concrete
9. ASTM C618 – Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
10. ACI-304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
11. ACI-305 – Hot Weather Concreting
12. ACI-306 – Recommended Practice for Cold Weather Concreting
13. ACI-308 – Standard Practice for Curing Concrete
14. ACI-506 – Recommended Practice for Shotcreting
15. CRD C-527 – Corps of Engineers Specifications for Polyvinylchloride Waterstop
16. CRSI – Manual of Practice
17. CRSI 63 – Recommended Practice for Placing Reinforcing Bars
18. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Indicate amounts of mix water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315. Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Submit five copies of each to Architect/Engineer.

E. Submittals Required:

1. Refer to General Conditions, Division 01, and Section 13 1101.
2. Shotcrete Nozzle Man Qualifications
3. Pool Finish Experience/Qualification Requirements
4. Concrete Mix Design
5. Non-Shrink Grouts
6. PVC and Compressible Waterstop
7. Expansion/Construction Joint Materials
8. Caulking

F. Shop Drawings Required:

1. Reinforcing Steel

G. Test Results:

1. Concrete Testing
2. Compaction

1.5 QUALITY ASSURANCE

A. Concrete Work: All concrete work in Division 13 11, including formwork and reinforcing, shall comply with applicable requirements of Division 13 11.

B. Qualifications of Pool Contractor

1. Work of this Section shall be performed by a Contractor who has a proven record of competence and experience in the construction of similar facilities of this size and complexity for not less than 5 years. Contractors shall have an established record of reliability.

C. Qualifications of Nozzleman and Gunman

1. Except when shotcrete is applied under a fully automated process, the quality of shotcrete depends largely on the skill of nozzleman and gunman, and the Contractor shall satisfy the Architect/Engineer that the nozzleman has had a minimum of two years' continuous experience on shotcreting of this type of work, and that the gunman has handled the gun for a period of at least six months. The nozzleman shall show proof of good quality successful shotcreting work similar to that required for this project. Experience gained on shotcrete and ditch construction will not be considered as experience for qualifying the nozzleman.

D. The following tests shall be performed during construction of the project. Refer to General Conditions and Division 01 for further requirements.

1. Concrete
   a. Tests to measure slump, entrained air content and compressive strength shall be conducted by independent testing laboratory employed by the Owner.
      1) Provide minimum of four (4) test cylinders per 50 cubic yard or fraction thereof for each class of concrete poured each day. Comply with ACI-318, Subsection 4.3 (samples secured - ASTM C172, cylinders prepared and cured - ASTM C31, and tested - ASTM C39). Identify samples moist cure at 70 degrees F for five (5) days and ship samples to laboratory.
   b. Slump and Air Content Tests
      1) Perform on concrete from same batch as sampled for strength tests and whenever there is consistency of concrete. Slump tests shall be made in accordance with ASTM C143. Air content tests shall be made in accordance with ASTM C231. If measured slump or air content falls outside specified limits, check shall be made immediately on another portion of same sample. In event of second failure, concrete shall not be used in Work.
   c. Compliance
      1) Average of any three (3) consecutive strength tests for each class of concrete shall be equal to or greater than specified strength, and no individual test shall fall more than 500 psi below specified strength.
      2) When tests results are below specified requirements or when tests of field cured cylinders indicate deficiencies in protection and curing, Architect/Engineer may require additional tests in accordance with ACI-318, Subsection 4.3.
2. Wet Mix Process Cylinder Sample
   a. Where automated wet mix equipment is used, shotcrete cylinders shall be taken from the mixer or ready-mix truck and tested in accordance with the requirements specified in this Section. Wet mix processes shall only be used with approved automated equipment.
   b. Surge Tanks – Prior to backfilling around surge tanks, contractor shall water test tanks per ACI 350.1, Chapter 2. Criteria shall be HST-050. Documentation of surge tank testing and results shall be submitted for review. Surge tank contractor is responsible for all costs related to surge tank testing and any corrections for leakage.

1.6 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Refer to General Requirements and Division 01.

B. Deliver cementitious materials to work site in manufacturer's standard packages. Immediately upon delivery to work site, store in waterproof sheds. Sheds required shall be provided by the Pool Contractor. No cementitious or other material that has become caked or hardened will be permitted in the work.

1.8 WARRANTIES

A. Special 2-Year on Concrete Structure: The Pool Contractor shall guarantee for two (2) years repair of the concrete pool structure.

PART 2 - PRODUCTS

2.1 CAST-IN-PLACE CONCRETE

A. Admixtures:

3. Water Reducing Admixture. Refer to ASTM C494.
4. Shrinkage Reducing Admixture. Grace Eclipse Floor or approved equal.
5. Air-Entraining Admixture: Provide air-entraining admixture in all concrete that will be exposed to freezing and thawing cycles. Refer to ASTM C260.

B. Concrete shall be ready-mixed conforming to ASTM C 94 and these Specifications. The use of non-agitating equipment will not be allowed.

C. Fine Aggregates: Conform to ASTM C 33. Materials finer than the 200 sieve shall not exceed 4 percent. Use only clean, sharp, natural sand.

D. Coarse Aggregate: Conform to ASTM C 33. Use only natural gravels, a combination of gravels and crushed gravels, crushed stone, or a combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension). Materials finer than the 200 sieve shall not exceed 0.5 percent. Size of coarse aggregate shall be 3/4 inch on slabs and footings; 3/4 inch for walls. Approval of other aggregate gradations must be received in writing before use on the project.

E. Portland cement shall be Type I, conforming to ASTM C150

F. Slump range shall be 2 to 4 inches. The water-cement ratio shall not exceed 0.45 by weight and the minimum cement content shall be 564 pounds per cubic yard - 6 bag mix. Submit complete data on the concrete mix for approval in conformance with the requirements of ASTM C 94, Alternate 2.

G. When applicable, the air entrainment shall be between 6 percent plus or minus 1.5% by volume.

H. Minimum allowable 28-day compressive field strength shall be 4000 psi when cured and tested in conformance with ASTM C 31 and C 39.

2.2 SHOTCRETE CONCRETE

A. Mix Design

1. Wet-mix design only. Dry mix, mixed at the nozzle shall not be allowed.
2. A proven mix design shall be used for all Shotcrete applications.
3. The shotcrete mix design shall be submitted 40 days prior to use.
4. The redi-mix supplier to be used shall submit an analysis of the aggregate and sand to be used.
5. The cement used shall conform to ASTM C 150 Type I.
6. Applicable to concrete exposed to freezing and thawing cycles: The total volumetric air content of shotcrete before placement shall be 7.5%, plus or minus 1.5%, as determined by ASTM C173 or ASTM C231. Air entraining agents shall meet requirements of ASTM C260, C231 and C457.
7. Shotcrete strengths: at 28 days shall be no less than 5,000 psi. In addition to cylinders, testing of shotcrete shall be done per ACI 506.2.

B. Rebound

1. Rebound is aggregate mixed with some cement, which ricochets off the surface during the application of shotcrete because of collision with the hard surface, reinforcement, or with the aggregate particles themselves, which amount varies with the position of the work, air pressure, cement content, maximum size and grading of aggregate, amount of reinforcing and thickness of layer. Rebound materials may not be reused in any form for shotcrete work and shall never be worked into the construction by the nozzleman.

2.3 FLY ASH

A. Fly Ash: Conform to ASTM C618. Limit the cement replacement to 20 percent by weight. Use Type C, Type F or pre-approved equal.

B. Ground Granulated last Surface Slag: Conform to ASTM C989. Limit the cement replacement to 20% by weight. Use Grade 120.

2.4 REINFORCING STEEL

A. Use deformed bars of sizes shown on the drawings conforming to ASTM A 615 Grade 60.

2.5 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete.

2.6 CONCRETE ADMIXTURES

A. Air-entraining admixture: Provide air-entraining admixture in all concrete that will be exposed to freezing and thawing cycles. Admixture shall conform to ASTM C260, except it shall be nontoxic after 30 days and shall contain no chlorides. Furnish manufacturer's compliance statement for these requirements to Architect/Engineer/Owner forty days prior to use.

B. Water-Reducing Admixture: All concrete shall contain a water-reducing admixture. The admixture shall conform to ASTM C 494, Type A or Type D; except it shall contain no chlorides, shall be nontoxic after 30 days, and shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations. Furnish a compliance statement that the admixture used satisfies all requirements of this Specification to Architect/Engineer forty days prior to use.

C. XYPEX Crystalline Waterproofing Additive: Concrete for the surge tanks walls and floor shall contain XYPEX. Dosage rates as recommended by the manufacturer.

2.7 PRE-MOLDED EXPANSION JOINT FILLER

A. Multicellular, closed cell, flexible polyethylene plastic foam as manufactured by Dow Chemical Co., Midland, MI. Ethafoam expanded polyethylene closed-cell foam, W.R. Meadows, Elgin, IL, Ceramar or a pre-approved equal.

2.8 WATERSTOP

A. PVC Waterstop

1. Center bulb type, as shown on Drawings, extruded from an elastomeric plastic compound, the basic resin of which shall be polyvinyl chloride (PVC). The size shall be as shown. Specific gravity shall be approximately 1.37, and the Shore durometer Type A hardness approximately 80. No reclaimed PVC shall be used in the compound. Meet the performance requirements of CRD C-572.
2. Waterstop shall have a constant thickness from the edge of the bulb to the outside edge. All waterstops shall have a number of parallel ribs or protrusions on each side of the center of the strip. Corrugated type or tapered waterstops are not acceptable. The minimum

weight per foot for waterstop shall be 1.52 pounds for 3/8-inch by 6-inch and 2.30 pounds for 3/8-inch by 9-inch.

3. Manufacturers and suppliers who have provided samples meeting the specified geometry and who have the specified waterstop readily available are listed below. Other products shall not be used without prior review and acceptance by the Architect/Engineer.
   a. Sika Greenstreak Waterstops, P.O. Box 7139, St. Louis, Missouri 63177, phone: (314) 225-9400 or fax: (314) 225-9854. Style 717 for the 6-inch by 3/8-inch and Style 735 for the 9-inch by 3/8-inch.
   b. BoMetals, Inc., 141 Hammond Street, Carrollton, GA. Phone 770-832-2000 or fax (770-832-2095.Style RCB638NT for the 6-inch by 3/8" and style RCB938NT for the 9-inch by 3/8".
   c. Paul Murphy Plastics Company, Wirestop Waterstop, 15301 Eleven Mile Road, Roseville, Michigan, 48066, phone 800-544-2200 fax 586-774-9146. Style CR-6380 for the 6-inch x 3/8" and Style CR-9380 for the 9-inch by 3/8".

B. Compressible Waterstop

1. Use as illustrated in drawing details for the following:
   a. Sealing non-moving cold joints and construction joints between structural elements against penetration of water from wet-face of structure with less than 30-foot hydrostatic head.
   b. Sealing pool piping penetrations against water penetration from wet-face of structure with less than 30-foot hydrostatic head.
2. Product Description: The product shall be a 0.59" x 0.39" compressible hydrophilic sponge rubber strip composed of vulcanized rubber and urethane polymer as the hydrophilic agent.
3. Product & Manufacturer:
   a. Adeka KBA-1510FP waterstop, manufactured by Adeka Corporation and distributed by OCM, Inc., Chicago, IL. USA.
   b. Website: www.adeka.com
4. Physical & Swelling Property Requirements: The product shall at a minimum meet the physical properties as shown in the official Adeka literature as follows.
   a. Expansion Pressure: The product shall not produce more than 0.03MPa (4.35 psi) expansion pressure when fully hydrated.
   b. Tensile Strength: At least 0.78 MPa (113 psi),
   c. % Elongation: No greater than 350% when fully hydrated,
   d. Volume (thickness) % Change: No greater than 30% volume change or increase in thickness when fully hydrated.
5. Alternative Products
   a. General: Drawing documents have been completed using the specified Adeka waterstop product as a basis of design. Alternative compressible waterstops shall not be used without approval from Engineer/Architect. Considerations such as concrete coverage requirements and wall thicknesses must be considered when substituting alternative products. Contractor will be responsible for any structural changes required due to alternate product concrete coverage requirements.
   b. Product Requirements: Compressible waterstop alternatives may not contain bentonite materials and may not have swelling properties that exceed the specified product.
   c. Acceptable Alternative: An acceptable alternative may be Synko-Flex SF302 Preformed Plastic Adhesive Waterstop with Synko-Flex SF300 emulsion primer or equal, but it must be approved prior to use. Manufacturer: Henry Company, Houston, TX. Website: http://us.henry.com/

2.9 NON-SHRINK GROUT

A. Upcon High Flow, the Upco Company, Cleveland, Ohio; Master Flow 713, The Master Builder Company, Cleveland, Ohio; Crystex, L & M Construction Chemicals, Inc., Omaha, Nebraska.

2.10 GUN GRADE SEALANTS

A. two-part polysulfide sealant and primer certified by Manufacturer as suitable for use in pools including submerged locations. "Deck-O-Seal Gun Grade" and "P/G" solvent based primer as manufactured by W.R. Meadows or equal. Color shall be white.

PART 3 - EXECUTION

3.1 CAST-IN-PLACE CONCRETE

A. Concrete shall be agitated by at least 70 revolutions of the mixing drum but not by more than 270 revolutions. Concrete shall be placed within 1-1/2 hours after the cement has been added to the mix.

B. Provide concrete blocks of same strength as the concrete mix to support reinforcing bars. Do not use broken concrete, brick or stone.

3.2 WATERSTOP

A. If shotcrete is applied to pool walls within 24 hours of the pool floor pour, the waterstops may be omitted with prior written approval from the Architect/Engineer.

B. PVC Waterstop

1. Split formwork is generally required for slab-to-slab, slab-to-wall and wall-to-wall joints where ribbed style waterstops are used. The centerline of the waterstop should be aligned with the center of the joint. The split form shall firmly hold the waterstop in position to prevent misalignment of waterstop during concrete placement. Secure waterstop with hog rings or integral wire loops prior to concrete placement. Loop tie wires through the hog ring/wire loops and tie off to adjacent reinforcing steel to prevent displacement of the waterstop during concrete placement. Fasteners through the body of the waterstop are not permitted.

2. Lapping of the waterstop is not permitted. PVC waterstop may be butt spliced in the field with Teflon coated, thermostatically controlled splicing iron. Direct exposure to a flame is not permitted. Factory fabricated fittings are recommended for ells, tees and crosses.
   a. The following defects at splices will not be acceptable:
      1) Use of adhesives, solvents, or free lap joints
      2) Misalignment of centerbulb greater than 1/16"
      3) Misalignment that reduces waterstop cross section area more than 15%.
      4) Bond failure at joint, deeper than 1/16" or 15% of material thickness.
      5) Combination misalignment and bond failure with net reduction of waterstop cross-section area greater than 15%.
      6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of ½" in 10 feet.
      7) Visible porosity in the weld joint, including pinholes
      8) Charred or burnt material
      9) Bubbles or inadequate bonding detectable with a penknife
      10) Visible signs of splice separation when cooled splices are bent at a sharp angle.
      11) Edge welding

3. Thoroughly consolidate the concrete around the waterstop to prevent voids or honeycombing next to the waterstop. Maintain adequate clearance between reinforcing steel and the waterstop. Typical clearance should be twice the maximum aggregate size. Maintain continuity of the entire waterstop system. Properly store PVC waterstops prior to installation to prevent UV degradation.

C. Compressible Waterstop – Adeka KBA-1510FP

1. Non-moving Joint Installation:
   a. Consult manufacturer and follow all recommended installation instructions.
   b. Allow concrete to cure a minimum of 24 hours.
   c. Concrete must be dry and free from form oils, release agents, curing compounds, laitance and other dirt or debris prior installation. Use a wire brush to remove contaminants prior to installation of waterstop.
   d. Use butyl tape to attach KBA-1510FP to a dry and clean substrate. The butyl tape comes in a 3/4" X 1/8" X 82-foot roll (1 roll per roll of KBA-1510FP). Press the butyl strip onto the substrate and remove the release paper. Press the KBA-15010FP firmly onto the butyl tape.
   e. Check for any gaps between the product and the substrate. If gaps are present, fill in using Adeka P-201 applied to the side of the strip. Use P-201 on corner joints and on side-by-side splice joints.
   f. Once installed, keep the product covered, clean, and dry prior to concrete placement. For best results, place the waterstop product immediately before pouring concrete. Check to make sure the waterstop is firmly adhered before placing concrete.
   g. During concrete placement, assure that the concrete is well consolidated around the waterstop at all locations with no voids or gaps.
2. Pipe Penetration Installation:
   a. Consult manufacturer and follow all recommended installation instructions.
   b. Pipe must be dry and free from form oils, release agents, curing compounds, laitance, and other dirt or debris prior to installation.
   c. Press the butyl strip onto the clean pipe completely around the pipe diameter and remove the release paper. Press the KBA-15010FP firmly onto the butyl tape. Tightly butt strip ends together with 1" overlap or side lap.
   d. Once installed, keep the product covered, clean, and dry prior to concrete placement. For best results, place the waterstop product immediately before pouring concrete. Check to make sure the waterstop is firmly adhered before placing concrete.
   e. During concrete placement assure that the concrete is well consolidated around the waterstop at all locations with no voids or gaps.
3. Alternative Products Installation:
   a. Drawing documents have been completed using the specified Adeka waterstop product as a basis of design. Alternative flexible adhesive waterstops shall not be used without approval from Engineer/Architect. See Part 2 for additional information.
   b. If Synko-Flex has been approved during the submittal process, the following installation requirements shall be met, as well as all manufacturer's installation instructions.
   c. Allow concrete to cure a minimum of 24 hours before priming with Synko-Flex primer.
   d. Concrete must be dry and free from form oils, release agents, curing compounds, laitance and other dirt or debris prior to priming. Use a wire brush to remove contaminants prior to installation of primer.
   e. Apply Synko-Flex SF311 primer.
   f. Apply Synko-Flex SF302 Preformed Plastic Adhesive Waterstop over primed areas. Place Synko-Flex to primed areas at an approximately 5/8" thickness and approximately 1 ½" width.
   g. Tightly butt strips together with 1" overlap or side lap.

3.3 FORMWORK

A. Forms: Materials shall produce tight forms and an acceptable finish.

B. Form Ties: Constructed so that the tie remains embedded in the wall, except for a removable portion at each end. Form ties shall have conical or spherical type inserts. Inserts shall be fixed so that they remain in contact with forming material and shall be constructed so that no metal is within 1 inch of the concrete surface when the forms, inserts and tie ends are removed. Wire ties will not be permitted. Ties shall withstand all pressures and limit deflection of forms to

acceptable limits. Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1 inch and sufficient dimensions to permit proper patching of the tie hole.

3.4 WORKMANSHIP

A. Forms: Construct forms accurately to dimensions and elevations required and to be strong and unyielding. Construct forms with tight joints to prevent the escape of mortar and to avoid the formation of fins. Brace as required to prevent distortion during concrete placement.

B. Placing reinforcing steel: Place reinforcing steel in conformance with the information on the Contract Drawings and CRSI Recommended Practice for Placing Reinforcing Bars, except as modified herein. Minimum length of splices shall be as shown in table on Contract Drawings. Tie splices with 18-gauge annealed wire as specified in the referenced CRSI standard.

C. Placing concrete:

1. Prior to placing concrete, remove water from excavation and all debris and foreign material from forms. Check the reinforcing steel for proper placement and correct any discrepancies.
2. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 2 feet deep. The vertical drop to final placement shall not exceed 6 feet. Placement shall conform to the requirements of ACI 318, except as modified herein.
3. Do not place concrete when the ambient temperature is below 40 degrees F and falling without special protection. Any concrete damaged by freezing shall be removed and replaced at no additional cost to the Owner.
4. Compaction: Apply approved vibrator at points spaced not farther apart than vibrator's effective radius. Apply close enough to forms to vibrate surface effectively but not damage form surfaces. Vibrate until concrete becomes uniformly plastic. Vibrator must penetrate the fresh placed concrete and into the previous layer of fresh concrete below.

3.5 CONSTRUCTION JOINTS/EXPANSION JOINTS

A. Caulk all expansion joints with gun grade sealant.

3.6 FINISHING

A. Screed surfaces of floor slabs and tops of exposed walls to true level planes. After the initial water has been absorbed, float and trowel with steel trowel. Provide rough broom finish on floor and walls to accommodate special aggregate mechanical bonding requirements.

B. Do not absorb wet spots with neat cement. Pool floors shall not vary from level or true plane more than 1/4 inch in 10 feet when measured with a straightedge.

3.7 FORM REMOVAL

A. Remove after concrete has set sufficiently to carry the dead load and construction load it has to sustain. Remove forms with care to prevent scarring and damaging the surface.

3.8 PROTECTION AND CURING

A. Protect fresh concrete from direct rays of the sun, drying winds and wash by rain. The method of water curing shall be the responsibility of the Contractor; however, the method used shall guarantee that all concrete surfaces remain wet to the touch, (free moisture present), at all times during the cure period.

B. Wet cure shall be used conforming to ACI 308. Keep concrete slabs and wall continuously wet for a 7-day period. Intermittent wetting is not acceptable. Any product used shall be compatible with finish bond requirements.

3.9 PROTECTION OF ADJACENT SURFACES

A. Contractor shall take every possible precaution to protect adjacent concrete surfaces, equipment, etc., from being damaged by overshooting concrete. Overshot concrete and rebound materials deposited shall be removed at the Contractor's expense.

3.10 FINISHING FORMED SURFACES

A. Areas not subject to water: Cut out all honeycombed and defective areas. Cut edges perpendicular to surface at least 1 inch deep, no feather edge allowed, and patch. Using bonding agent, fill holes flush with cement mortar composed of 1 part cement and 2 parts sand. Rub surface with wood float and burlap. Keep patches damp for a minimum of seven days. Fill all form tie holes in same manner.

B. Areas subject to water: Cut out all honeycombed and defective areas, cut edges perpendicular to surface at least 1 inch deep, no featheredge allowed, soak area to be patched for 24 hours, then allow surface to drain free of standing water, then patch with color matched non-shrink grout:

C. The grout used shall be cured as recommended by grout manufacturer.

3.11 POOL WALL SHOTCRETE

A. Wet Mix Process

1. The delivery equipment shall be of an approved design and size that has given satisfactory results in similar previous work.
2. The equipment must be capable of discharging mixed material into the hose under close control, and it must be able to deliver a continuous smooth stream of uniformly mixed material at the proper velocity to the discharge nozzle, free from slugs of any kind.
3. The nozzle shall be of a design and size that will ensure a smooth and uninterrupted flow of materials.
4. Delivery equipment shall be thoroughly cleaned at the end of each shift.

B. Surface Preparation

1. Verify forms are true to line and dimensions, adequately braced against vibration, and constructed to permit escape of air and rebound during gunning operations.
2. Do not place shotcrete on any surface which is frozen, spongy, or where there is free standing water.

C. Alignment Control

1. Provide alignment wires to establish thickness and plane surface.
2. Install alignment wires at corners and offsets not established by form work.
3. Verify alignment wires are tight, true to line, and placed to allow further tightening.

3.12 Application

1. Ensure correct placement of reinforcement. Ensure sufficient clearance around reinforcement to permit complete encasement.
2. Allow easy access to shotcrete surfaces for screeding and finishing, permitting uninterrupted application.

3. Determine operating procedures for placement in close quarters, extended distances, or around unusual obstructions where placement velocities and mix consistency must be adjusted.
4. In shotcreting walls, begin application at bottom. Ensure work does not sag.
5. Hold nozzle as perpendicular to surface as work will permit, to secure maximum compaction with minimum rebound.
6. Follow routine that will fill and completely encase reinforcement, using maximum layer thickness.
7. Build up layers by making several passes of nozzle over work area. Completely encase reinforcement with first layer.
8. After initial set, remove excess material outside of forms and alignment lines.
9. Allow each layer of shotcrete to take initial set before applying succeeding layers.
10. Remove laitance that has taken final set, by sandblasting. Clean with air-water jet.
11. Sound work with hammer for voids. Cut out voids and replace with succeeding layers.
12. Keep rebound, and other loose or porous material out of new construction.
13. Remove rebound that does not fall clear to work. Discard salvaged rebound.
14. Remove trapped rebound at construction and expansion joints.

3.13 EXPANSION JOINTS

A. The pre-molded expansion joint filler shall be of sufficient width to completely fill the joint. Filler shall be accurately cut to butt tightly against the waterstop and the side forms. All expansion joints require PVC waterstop.

B. At locations where joint sealant is to be applied, the pre-molded joint filler shall be precut to the required depth.

C. Cavities for joint sealant shall be formed with either precut, pre-molded joint filler or smooth, accurately shaped material that can be removed.

D. Concrete shall be thoroughly vibrated along the joint form to produce a dense, smooth surface. Surface irregularities along the joint sealant cavity, due to improper concrete consolidation or faulty form removal, shall be repaired with an approved compound compatible with the joint sealant in a manner that is satisfactory to the sealant manufacturer.

E. Installation of Cellular Neoprene: Install in joint accurately as shown. Attach to concrete with a bonding agent approved in writing by the joint sealant and joint filler manufacturer for compatibility.

F. All joints require gun grade sealant.

3.14 CONSTRUCTION JOINTS

A. Construction joints shall be located as required for the contractor's scheduling, means and methods.

B. All construction joints require waterstop.

C. Contractor shall provide a submittal showing construction joint locations and detailing for review and approval.

3.15 PLACING REINFORCING STEEL

A. Place reinforcing steel in conformance with the information on the drawings and CRSI 63 and CRSI, except as modified herein. Minimum length of splices shall be as shown in table on drawings. Tie splices with 18-gauge annealed wire as specified in the referenced CRSI

standard. All tie wires shall be "made tight" for electrical bonding purposes, as required by NEC, Article 680.

3.16 WATER TIGHTNESS TEST

A. General

1. This test applies to the pool, the surge tank, and the gutter system. A water tightness test shall be completed on each pool, surge tank and gutter system, independently of each other, prior to the application of the pool finish.
2. The cost of the water for one initial water tightness test, and the final fill shall be borne by the CONTRACTOR. Any subsequent fillings or partial fillings (more than 25%) of the pool shall be by the CONTRACTOR, at its own expense.
3. Contractor shall include and itemize these requirements in the overall construction schedule.
4. The Owner may elect to waive leak test requirements if schedule becomes a critical factor. Only the Owner may waive these requirements. If the Owner elects to waive these requirements the Contractor is still responsible for providing leak-free structures, and at a minimum, all specified applicable warranties shall apply.

B. Water Tightness Test Procedure

1. Preparation
   a. Visually examine the concrete structure and joints for potential leakage prior to fill. Contractor shall repair areas of potential leakage prior to fill.
   b. Allow the concrete structure to cure a minimum of 28 days, or as required to gain sufficient strength to withstand the test load, prior to initiating test.
   c. Securely seal all inlets/outlets and penetrations prior to fill.
   d. The test shall not be scheduled when the weather forecast indicates the water surface could freeze before the test is completed.
2. Fill
   a. Fill the pool with potable water from an approved water source, and then isolate the pool, the surge tank, and the gutter system. The water tightness test and measurement documentation shall begin after the test structure has been filled for a minimum of three (3) days to allow the concrete to absorb water and minimize absorption effects during the testing period.
   b. Fill each structure to the design maximum liquid level or 4 inches below any fixed overflow level.
   c. After the initial fill, remove ground water to a level below the bottom of the structure main drain or floor slab (below lowest concrete plane) utilizing the pool observation tube, the pool de-watering system, or the construction dewatering system. This shall be completed prior to the start of the water tightness test and maintained for the duration of the test.
3. Evaporation/Precipitation Measurement Procedure
   a. Partially fill a floating, restrained, calibrated (known volume and surface area), open container (hereafter "container" or "control container") with water and allow this container to float within the filled structure during the testing period. This will be used to measure total evaporation and precipitation.
   b. Mark and measure the change in container's water level. If the container water level has gone down (evaporation), this change shall be subtracted from each structure's water loss measurement. If the container water level has risen (rain), this change shall be added to each structure's water loss measurement.
4. Measurement
   a. Conduct all measurements with the Architect or Owner's representative present and document all measurements on the table below.
   b. Provide an as-built drawing or sketch the pool, surge tank, and gutter identifying measurement locations and the evaporation control container's location.

c. The water surface elevation shall be recorded to within 1/16 of an inch, measured from a fixed point on the structure above the water surface.
d. Average multiple sample locations for structures exposed to wind.
e. Repeat and record the measurements for a total of three (3) consecutive days.

Measurement Times	Pool Measurements	Gutter System Measurements	Surge Tank Measurements	Control Container Measurements
12 Hrs.				
24 Hrs.				
36 Hrs.				
48 Hrs.				
60 Hrs.				
72 Hrs.				

5. Water Leakage
   a. Calculate water leakage as follows:
      Leakage [Gallons]= [7.481 x Structure Surface Area (SF)] x
      [Structure Loss Measurement* (FT) – Control Container Measurement (FT)].

      * Structure loss measurement is a generic term referring to Pool Measurement, Gutter System Measurement or Surge Tank Measurement independently. Calculate the leakage from the pool, gutter, and surge tank independently.

   b. Add the measurements for two consecutive 12-hour periods to obtain the total daily loss due to leakage.
   c. Record Daily losses due to leakage for Day #1, #2, and #3 in the table below.

Total Daily Loss Due To Leakage	Pool Leakage	Gutter Leakage	Surge Tank Leakage
Day 1			
Day 2			
Day 3			

6. Submittal
   a. Provide test location as-built/sketch, measurement tables, and Water Leakage calculations to Engineer in the form of a submittal for review and records.
7. Allowable Loss from Leakage
   a. The allowable leakage rate for an unlined, open concrete structure (i.e. backfilled pool, gutter, and surge tank) 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.)
   b. Elevated pools and gutters with a secondary containment vessel shall have no measurable loss; the drop in the water surface shall not exceed 1/8" over the three-day test period when adjusted for evaporation and precipitation.
8. Repair and Retest
   a. If the leakage volume calculated exceeds the "allowable loss" in section 7, Contractor shall locate and identify leakage points, repair the structure and provide documentation on the location of repaired areas.
   b. After proper curing of all repair work, re-test the water tightness of structure following the procedure specified in this section.

END OF SECTION 13 1118

SECTION 13 1120 - POOL PIPE & PIPE FITTINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, connections, wall penetrations.

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 REFERENCES/PIPE – FITTING REQUIREMENTS

A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.
   1. ANSI/ASTM D2564 - Solvent Cements and ASTM F656 – Primers for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings
   2. ASTM D2855 – Practice for Making Solvent Cemented Joints with PVC Pipe and Fittings
   3. ANSI/ASTM D1785 – Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Schedules 40, 80 and 120, NSF Seal for Potable Water
   4. ASTM D2466 – PVC Plastic Pipe Fittings, Schedule 40, Injection Molded, Sizes Through 12", NSF Listed. As manufactured by Spears Manufacturing Company, "or approved equal".
   5. ASTM D2467 – Socket Type PVC Plastic Pipe Fittings, Schedule 80, Injection Molded, Sizes through 12", NSF Listed. As manufactured by Spears Manufacturing Company, "or approved equal".
   6. ASTM F679 – PVC Large Diameter Plastic Gravity Sewer Pipe and Fittings, Bell Gasketed Joints, Sizes 18" Through 36". As manufactured by J-M Manufacturing Co., Inc. "Perma-Loc", "or approved equal".
   7. ASTM B88 – Seamless Copper Water Tube
   8. Eslon Engineering Manual for Plastic Piping Systems
   9. ASTM D2563 – Fabricated, Fiberglass Wrapped PVC Pipe Fittings 12", 14", and above, Schedule 40 or 80 manufactured from PVC pipe conforming to ASTM D1785 and compliant to the most recent publication of the "Spears General Specification for Standard Fabricated Fittings (FAB-7-702)". Butt-fusion welded fabricated fittings are not acceptable. All fittings shall be certified for potable water service by NSF. As manufactured by Spears Manufacturing Company or "approved equal"
   10. CLASS 150 - All plastic pipe flanges shall be Class 150 and of the same schedule as the associated pipe with neoprene gaskets where required.
   11. ASTM D638 – Standard Test Method for Tensile Properties of Plastics
   12. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

1.4 QUALITY ASSURANCE

A. Qualifications of Pool Contractor
   1. Work of this Section shall be performed by a Contractor who has a proven record of competence and experience in the construction of similar facilities of this size and complexity for not less than 5 years. Contractors shall have an established record of reliability.

B. The following tests shall be performed during construction of the project. Refer to General Conditions and Division 01 for further requirements.
   1. Testing and Flushing of Piping

a. Contractor shall be responsible for discovering leaks and making necessary repairs.
   1) Pressure piping and suction piping: After the piece is laid, the joints completed and the trench partially backfilled, leaving joints exposed for examination, subject new lines to a hydrostatic pressure of not less than 50 pounds per square inch. Joints shall remain watertight under this pressure for a period of two (2) hours. All air must be expelled from pipes prior to testing.
   2) Gravity lines: A water test shall be applied to all gravity drain piping systems, either in their entirety or in sections. All openings shall be tightly plugged and each system filled with water and tested with at least a 10 foot head of water (4.3 psi). The water shall be kept in the system, or in the portion under test, for at least fifteen (15) minutes before the inspection starts. System shall be water tight at all joints.
   3) Leaks shall be repaired and tested repeatedly until leakage or infiltration is approved.
b. Provide test results to the Architect/Engineer before covering with concrete.

1.5 SUBMITTALS

A. Refer to General Requirements and Division 01.

B. Product Data: For each type of manufactured material and product indicated.

C. Provide Shop Drawings showing all pipe penetration locations through concrete pump pit walls and concrete surge tank walls. Include dimensioned location of pipe penetrations in plan and elevation view, pipe sizes, sleeve sizes, link-seal sizes, and sleeve and link-seal material/product information.

D. Provide a submittal including system drain valves and location of drain valves for Owner's use during pool shut-down and/or pool winterizing.

1.6 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Refer to Section 1.03 for pipe and fitting requirements.

B. Refer to pipe schedule(s) on drawings for size and type.

2.2 THREAD TAPE

A. Teflon 2

2.3 SOLVENT CEMENTS AND PRIMERS

A. PVC pipe shall be installed using solvent weld materials including primers, cleaners, and cements. All solvent weld materials, methods, and applicator tools shall conform to all ASTM Standards for solvent cements used for plastic pipe installations.

B. Manufacturer: IPS Corporation, Weld-On Product Line

2.4 WALL SLEEVES

A. Pipes penetrating all water tight walls shall use "Century Line" thermoplastic wall sleeves in combination with "Link Seals" having stainless steel service designation. As manufactured by Thunderline Corporation, or the Metraflex Company, "or approved equal".

2.5 NON-SHRINK GROUT

A. Upcon High Flow, The Upco Company, Cleveland, Ohio; Masterflow 713, The Master Builder Company, Cleveland, Ohio; Crystex L & M Construction Chemicals, Inc., Omaha, Nebraska.

2.6 PIPE SIGNAGE

A. Brady, B-946, custom legend, self-sticking markers and arrows or equal.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. Excavation and Backfill
   1. Excavation for all pool systems and related piping.
      a. Comply with Division 31.
   2. Special backfill and bedding materials.
      a. Existing subsoil materials shall not be used for pipe bedding.
      b. All pipe shall be bedded with a minimum of 6" of clear stone material and a minimum of 2'-0" clear stone material top cover. The balance may be existing site material, provided no organic material, clay or topsoil is used.

B. Piping Placement and Use
   1. Base Bid shall be on pipe materials shown. See the PL Drawings and associated schedules for required pipe material types.
   2. All material transitions shall be above-grade, flange to flange connections and include ribbed EPDM type rubber gaskets. Below-grade materials transitions will not be allowed.
   3. Piping must be laid on a grade so it will drain completely by gravity. In all instances where gravity drainage is not provided, the contractor shall install drain valves so that all lines can be drained completely. Shop drawings will be required on any such installation.
   4. No installation shall be made that will provide a cross connection or inter-connection between distribution supply for drinking purposes and the swimming pool that will permit a backflow of water into the potable water supply. Pipe openings shall be closed with caps or plugs during installation. Equipment and pool fittings shall be tightly covered and protected against dirt, water and chemical or mechanical injury. At the completion of work the fittings, materials and equipment shall be thoroughly clean and adjusted for proper operation.
   5. All gutter lines shall drain by gravity to the surge tank.
   6. All above grade outdoor piping shall be painted, in accordance with the manufacturer's recommendations, to protect against ultraviolet degradation.

C. PVC Pipe
   1. Cut all pipe with mechanical cutter without damage to pipe.
   2. Placing and laying: Inspect pipe for defects before installation. Clean the interior of pipe thoroughly of foreign matter and keep clean during laying operation. Pipe shall not be laid in water or when trench conditions are unstable. Water shall be kept out of the trench until the pipe is installed. When Work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipes or fittings.
   3. Threaded joints: After cutting and before threading, the pipe shall be reamed and shall have burrs removed. Screw joints shall be made with graphite or inert filler and oil or with an approved graphite compound applied to male threads only. Threads shall be full-cut and

not more than 3 threads on the pipe remained exposed. Use Teflon II tape on the male threads of all threaded pipe joints. Caulking of threaded joints to stop or prevent leaks will not be permitted. Unions shall be provided where required for disconnection of exposed piping. Unions will be permitted only where access is provided.

4. All PVC pipe connections shall be flanged or solvent welded.
5. Solvent welded joints shall be made in accordance with the manufacturer's printed instructions and the following minimum standards:
   a. All fittings shall fit easily on the pipe before applying cement. The outer surface area of pipe and inner wall of fitting shall be dry and clean. Cleaner is to be applied to the outer surface of the pipe and to the inner surface of the fitting. Cement is to be applied to the outer surface of the pipe, or on the male section of fittings only. When the outside surface area of the pipe is satisfactorily covered with cement allow ten (10) seconds open time to lapse before inserting pipe end into fittings. After full insertion of pipe into fitting, turn fitting about the pipe end approximately 1/8 to 1/4 of a turn. Wipe off excess cement at the joint in a neat cove bead. Follow manufacturer's instructions on solvents. Remove all debris, including, containers, brushes, applicators and other items from premises, dispose of properly. Burying of debris on site is not permitted.
   b. In addition to the requirements outlined above, the solvent weld process for pipe sizes of 6" diameter and larger includes additional requirements outlined below. As pipe diameter increases, so does the difficulty in installing it. Follow all of the solvent weld manufacturer's recommendations for larger diameter pipe.
      1) The installer shall use proper size applicators to ensure enough cement is applied to fill the larger gap that exists between the pipe and fittings.
      2) Use the applicable cement for the size of pipe and fittings being installed.
      3) End of pipe must be cut square and chamfered (beveled).
      4) Provide adequate crew size to properly handle and fit pipe installations.
      5) It is important in large diameter joining that the primer and cement be applied simultaneously to the pipe and fittings. Apply a second, full layer of cement to the pipe. Pipe must be bottomed into the fitting.
      6) Large diameter pipe and fittings require longer set and cure times. Prefabricate as many joints as possible. If pipe is to be buried, fabricate as many joints as possible above ground, after joints have cured, carefully lower into trench.
   c. All joints shall remain completely undisturbed for a minimum of 10 minutes from time of jointing the pipe and fitting. If necessary to apply pressure to a newly made joint, limit to 10% of rated pipe pressure, during the first 24 hours after the joint has been made.
   d. Make provisions for expansion and contraction by way of swing joints or snaking.
   e. Protect plastic pipe from exposure to aromatic hydrocarbons, halogenated hydrocarbons, and most of esters and keytones that attack the material. Protect all pipe from mechanical damage and long exposure to sunlight during storage.
   f. PVC welding is not allowed without prior approval of the Architect/Engineer.

D. Field Coordination
   1. It is the Contractor's responsibility to provide piping by means that account for all necessary coordination, including, but not limited to: water stops, oversize sleeves, pipe supports, valves and other attachments, over-excavations required for fusion machinery or other equipment, etc.
   2. Provide pipe extensions and temporary caps necessary for pressure testing requirements.
   3. Contractor is required to provide coordination and adequate protection as needed to all external services (i.e. ducts, pipes, cables) that run throughout the project site. Plumbing shall be located and placed to prevent damage during and after construction from traffic loads above.

E. Overhead piping in mechanical room/pool room shall be run such that a minimum head clearance of 7'-0" is observed to all piping, pipe fittings and pipe hangers/supports. Piping runs shall not create path obstruction or a tripping hazard.

F. Pipe Identification

1. Provide identification on all piping located in mechanical equipment, chlorine, acid rooms, heater courts, etc.
2. All piping in Mechanical Room to be labeled with description of line and arrows indicating direction of flow.
3. Mark at least once on each line and at 5 ft. intervals minimum. Consult Health Department Code for minimum marking requirements.
4. Color code per Health Department requirements. If code does not identify color coding requirements consult Architect/Engineer.

3.2 SLEEVES AND WALL PENETRATIONS

A. Patch exterior side of wall penetrations with non-shrink grout. Other methods of water tightness shall be pre-approved by the Architect/Engineer.

END OF SECTION 13 1120

SECTION 13 1123 - POOL PIPE SUPPORTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe Hangers & Supports.

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 SUBMITTALS

A. Refer to General Requirements and Division 01.

B. Product data including manufacturer's specifications, installation instructions.

C. Shop Drawings showing type and locations.

1.4 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to General Requirements and Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hangers and Supports

1. General
   a. All hangers, pipe supports, threaded rod, hardware, etc. shall be zinc plated or galvanized steel.
   b. All piping connections and support hardware shall be stainless steel inside surge tanks and gutters.
2. Strut
   a. Minimum height 1 5/8", minimum width 1 5/8", minimum thickness 12-gauge material.
   b. Finish shall be hot-dip galvanized steel, ASTM A123; or type 304 stainless steel or better grade, ASTM A240.
3. Strut Clamps
   a. Pipe sizes ½" thru 12", two-piece clamps with clamping bolt and nut. Pipe sizes 14" and larger, provide "U" bolts, nuts and washers.
   b. Finish shall be hot-dip galvanized steel, ASTM A123; or type 304 stainless steel or better grade, ASTM A240.
4. Strut Accessories
   a. Flat plate fittings, corner braces, post bases, etc. Finish shall be hot-dip galvanized steel, ASTM A123; or type 304 stainless steel or better grade, ASTM A240.
5. Wedge Anchors
   a. One-piece assembly, 3/8" minimum body diameter.
   b. Grade 2, zinc plated with stainless steel clips; or type 304 stainless steel or better grade, ASTM A240.

6. Beam Clamps
   a. Steel "C" clamp type with locknut.
   b. Finish shall be electro-plated galvanized; or type 304 stainless steel or better grade, ASTM A240.
7. Support Components
   a. All threaded rod, threaded rod couplings, nuts, washers, etc. Finish shall be electro-plated galvanized; or type 304 stainless steel or better grade, ASTM A240.

PART 3 - EXECUTION

3.1 GENERAL

A. All mechanical room piping must be properly supported using the schedule indicated on the drawings as a guideline for maximum allowable spacing between supports.

B. It shall be the contractor's responsibility to properly support piping at all valves, pumps, equipment, overhead areas and changes in direction.

C. All piping must be supported laterally as well as vertically hung.

D. Ring, clevis, roller and J hook type hangers are not acceptable.

E. Comply with manufacturer's written instructions.

END OF SECTION 13 1123

SECTION 13 1124 - POOL VALVES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Butterfly Valves

B. Ball Valves

C. Check Valves

D. Expansion Joint/Flexible Connector

E. Modulating Float Valves

F. Modulating Electrical Main Drain Valves

G. Submerged Service Operators

H. Valve Operator Extension

I. Drainage Valves

J. Reducers

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 REFERENCES

A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.

1. ANSI – American National Standards Institute
2. ASTM – American Society of Testing Materials

1.4 SUBMITTALS

A. Refer to General Requirements and Division 01.

B. Submit Shop Drawings, clearly indicating make, model, location, type, size, pressure rating, and type of service.

C. Valve charts

1. Submit two copies of valve charts for each piping system, consisting of isometric Drawings, or piping layouts showing and identifying each valve and describing its function to the Architect/Engineer for approval.
2. Upon completion of the Work, one copy of each valve chart sealed to rigid backboard with clear lacquer, placed under glass and framed, shall be hung in a conspicuous location in the equipment room.

1.5 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to General Requirements and Division 01.

1.7 WARRANTIES

A. Standard Manufacturer's Warranty

PART 2 - PRODUCTS

2.1 GENERAL

A. Cast Iron valves 3" and larger shall have an epoxy coated body on all interior and exterior surfaces, ductile iron-nylon II coated disc, one piece 416 stainless steel shaft with Buna-N or EPDM seat minimum, 150 PSI rating, or cast aluminum ASTM S12A housing and fully coated with Rilsan on all interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated ductile iron disc and T304 stainless steel shaft. 150 psi rating.

B. Cast Aluminum valves 3" and larger shall have an ASTM S12A body and coated with Rilsan on all interior and exterior surfaces. Internal components include Buna-N or EPDM resilient lining and seat, Rilsan coated ductile iron disc and T304 stainless steel shaft. 150 psi rating.

C. Thermoplastic valves 3" and larger shall be constructed from PVC Type 1 Cell Classification 12454 or CPVC type 4 cell classification 23447. Thermoplastic valves shall include PVC disc with solid type 316L stainless steel shaft with Buna-N or EPDM seat pressure rated to 150 psi @ 73 degrees Fahrenheit.

2.2 BUTTERFLY VALVES

A. Butterfly valves 3" - 12" shall be wafer or lug bodies and shall be suitable for use between ANSI 125 and 150 lb. Flanges.

B. Bodies of the flangeless design shall be provided with at least two bolt guides to center the valve in the pipeline.

C. All valves shall be as manufactured by Bray Valve (713) 894-5454, Dominion or equal.

D. All bolts and nuts shall be corrosion resistant zinc plated steel with plated washers to be used when secured to PVC flanges.

2.3 UV LAMP STRAINER VALVE

A. EZ Strainer 4" to 12" butterfly type valve with stainless steel strainer disc and shaft, case aluminum rislan (nylan) coated valve housing, with manual locking valve handle as manufactured by Neptune Benson. Install on downstream side of UV lamp per UV installation details.

2.4 BALL VALVES

A. PVC True Union Ball Valves, Ipex, Asahi, Spears or equal.

2.5 CHECK VALVES

A. ½" thru 2 ½" shall be PVC body, true union, ball type, seal material EPDM as manufactured by Ipex, Asahi Spears or equal as indicated on Contract Drawings.

B. 3" thru 20" diameter check valves:

1. Type: Split disc wafer style
2. Valve Body: Ductile or cast iron with an epoxy painted exterior
3. Lining: Fully lined with a Buna N elastomer
4. Shaft: 316 stainless steel shaft and shaft plug
5. Plates: 316 stainless steel (3" – 12") or Aluminum Bronze (14"+)
6. Spring & Plate Travel Stop: 316 stainless steel
7. Manufacturer: Center Line Series 800 as manufactured by CRANE ChemPharma & Energy, or Model CVXXK Series by Metraflex, or approved equal.

2.6 EXPANSION JOINT/FLEXIBLE CONNECTOR (where required)

A. Shall be the Metrasphere, Style R with EPDM body and threaded bolt holes, Model #MSREE Series manufactured by Metraflex, as indicated on drawings. Install with a control unit assembly (tie rods) from flange to flange per manufacturer's instructions to minimize expansion joint damage caused by excessive motion.

2.7 MODULATING FLOAT VALVES

A. Float operated modulating valve shall be designed for submerged service.

B. The housing body shall be fabricated using Sch. 80 PVC pipe with Sch. 80 PVC van stone flanges. The internal wafer shall be 12 gauge T304L material and positioned with 1/8" (+1/16") clearance around the perimeter. The body shall also incorporate an interior stop plate constructed of PVC to define that allowable range of arm motion. Close fitting Delrin bushings shall be included on the shaft penetration of the body to provide a seal against water loss and air entrance.

C. The valve shaft shall be T304L material 1" in diameter. Float arms shall securely fasten to shaft using T316SS nuts with washers to provide adjustability. Arms shall be ½" diameter all thread rod T316SS with length as required. Valve sizes 14" – 20" shall have ¾" square tubing for arms.

D. Ball floats shall be constructed of T304L stainless steel and be 7" in diameter with internal weighting. Floats shall also be adjustable using T316SS nuts with washers as previously described. Provide one (1)/two (2) float arms as shown on the drawings. Valve sizes 14" – 20" shall have 12" diameter cylindrical floats.

E. The float arms shall be hinged to allow for vertical operation. A 12 gauge T304L bracket shall be provided as a guide to maintain the vertical float positions.

2.8 MODULATING ELECTRONIC MAIN DRAIN VALVES

A. The modulating electronic main drain valves shall be assembled and installed as specified in the Contract Drawings. The purpose of the valve is to use the surge tank and/or balance tank water level as a means of electronically adjusting and controlling the flow from the pool main drain plumbing.

B. Provide and install equipment as detailed in the Contract Drawings and as follows:

1. The surge tank sensor and transmitter (Basis of Design): Shall be a BECSys, Model SLS continuous level sensor, or equal with the following characteristics:
   a. Piezoresistive pressure measurement of the water column.

b. Automatically adjusts for changes in atmospheric pressure.
c. Factory calibrated.
d. Field configurable sensor length.
e. Solid-state; no moving parts that can wear out over time.
f. Installation options for wall mount and stand pipe glass configurations.

2. Digital Processor (Basis of Design): Is internal with the BECSys 7 Chemical Controller or approved equal (see pool mechanical and main drain detail on PL drawings). Program settings as shown on detail per the manufacturer's instructions. The controller shall continuously monitor, display and data log surge tank level with 10 mm (0.4") resolution or better. The controller shall also use the surge tank level to control a water makeup valve to maintain water level (Autofill) and/or control a main drain modulating valve.
3. Valve: One (1) butterfly valve. Valve shall be one pipe size smaller than the main drain pipe.
   a. See "Butterfly Valves" within this specification section for additional valve material and manufacturer requirements.
4. Valve Positioner:
   a. DHC-100 digital positioner, electronic actuator with manual over-ride wheel operator, and battery back-up.
   b. Positioner: Pushbutton calibration to plus/minus 0.1 degree within a 90-degree quadrant. See detail for range of positions. Fail position (loss of command/signal) shall be 100% closed.
   c. Electronic Actuator: Provide Series 92 Quarter master Protek Failsafe electric actuator with rechargeable battery pack and low battery indicator. Voltage: Available in 115/230VAC and 12/24VDC, 0.2 to 4.0 amp draw.
   d. Manufacturer: Asahi America, Inc., www.asahi-america.com; or equal.

2.9 SUBMERGED SERVICE OPERATORS

A. Use only approved service operators for the valve requiring underwater operation in the surge tank or in manhole used for pool draining.

2.10 VALVE OPERATOR EXTENSION

A. Extensions shall be stainless steel and by same manufacturer as the valve manufacturer.

2.11 DRAINAGE VALVES

A. Provide min. 3/4" True Union Ball valve on all piping at such a location to allow complete drainage of system.

2.12 REDUCERS

A. Use Eccentric reducers on pump suction lines only and concentric reducers on pump discharge lines only.

B. Stainless steel body and flanges, T304 materials, ANSI 125# rated flanges.

C. Use Neptune Benson, 15-CNS/15ECS series "or equal".

D. Provide valves of same manufacturer throughout where possible and practical.

E. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

2.13 VALVE LABELS

A. Provide and install 2" round, 1/16" thick, multi-layered valve tags with contrasting lettering with non-corrosive beaded tie on all valves. All labels shall be me labeled in accordance with the valve chart per Section 13 1114.

PART 3 - EXECUTION

3.1 VALVE CONNECTIONS

A. Provide valves suitable for connection to adjoining piping.

B. Valve size shall be the same as the pipe size.

3.2 VALVE USE

A. Pipe sizes 3" - 14" – Butterfly

B. Miscellaneous valves 1/2" – 2-1/2" - PVC True Union Ball Valves

C. All chemical lines and equipment - PVC True Union Ball Valves

3.3 VALVE OPERATORS

A. All butterfly valves shall have gear operators and chain operators as required unless drawings indicate otherwise. Chain operators shall be required on all gear operators located 7'-0" or higher above finished floor.

B. Provide extension lengths as necessary to operate submerged or below surface valves and the appropriate valve box access cover.

END OF SECTION 13 1124

SECTION 13 1125 - POOL CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pumps
   1. Flooded Suction

B. Pump Accessories
   1. Pump Strainers
   2. Gauges
   3. Flow meters

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 REFERENCES

A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.

   1. Hydraulic Institute Standards
   2. Institute of Electrical and Electronics Engineers Standards (IEEE)
   3. National Electrical Manufacturers Association Standards (NEMA)
   4. Occupational Safety and Health Administration Rules and Regulations (OSHA)
   5. National Sanitary Foundation (NSF)
   6. American Society for Testing and Materials Standards (ASTM)
   7. American Iron and Steel Institute (AISI)
   8. American National Standards Institute (ANSI)
   9. ASTM A48 – Standard Specification for Gray Iron Castings
   10. ASTM B584 – Standard Specification for Copper Alloy Sand Castings for General Applications
   11. AISI 1045
   12. ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Castings

1.4 DESCRIPTION OF WORK

A. The pumping units shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings by the Architect/Engineer.

B. Pump capacity, horsepower, TDH (Total Dynamic Head), speed, suction and discharge diameters, type, and other requirements shall be as shown on the drawings and shall comply with the requirements as specified herein.

C. The General Conditions shall apply to this Section as fully as if repeated herein.

1.5 QUALITY ASSURANCE

A. To assure a properly integrated and compatible system, the Equipment Manufacturer shall assume full responsibility for the warranty and proper operation of the pumps and/or accessory equipment.

B. Acceptable Products and Manufacturer: As listed on the contract documents or included herein or, an Engineer approved equal product and manufacturer.

C. All pumps and strainers shall be NSF50 certified as provided, including required coatings and shall be labeled as such on the serial number identification tag.

1.6 SUBMITTALS

A. Refer to General Requirements and Division 01.

B. Submit complete motor and pump data together with shop drawings for the driven machine. All material is to be collated in a card stock binder, with pockets for large drawings, and with index. This data shall be prepared by the motor and/or pump manufacturer and shall include:

1. Pump manufacturer and model number, name of motor manufacturer, type of pump and motor with dimensioned drawings.
2. Characteristic curves at full load motor speed showing flow, TDH, efficiency, horsepower, and NPSH required. For all VFD applications include a family of performance curves, separate of the full load motor speed curve, for speeds of 105%, 100%, 89%, 83%, 66%, and 50% of the scheduled RPM.
3. Nominal motor horsepower, speed at full load, frame size, enclosure construction, winding insulation class and treatment, temperature rise at nominal horsepower, service factor, voltage rating (indicate if dual voltage), number of phases, frequency rating, full-load amperes at nominal horsepower for application voltage, starting code letter, or locked rotor KVA or amperes.
4. Complete pump description plus material list including casings, impellers, seals, shaft, bearing frame, motor mounts, guards, base plate, exterior coating type and mill thickness.
5. Installation Instruction and Operation and Maintenance Manuals shall include recommended protection and maintenance required for storage prior to putting pumps in service and may be submitted any time before shipment of the pumps.

1.7 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Refer to General Requirements and Division 01.

1.9 WARRANTIES

A. Manufacturer's standard pump warranty. Warranty on mechanical seals covering 100% of the cost on all parts and labor extending over the same time period as the standard pump warranty.

B. Flooded Suction Pumps

1. Pump failure of any pump component directly attributable to materials and/or workmanship within one (1) year after substantial completion shall be repaired or replaced by the pump manufacturer at no cost to the Owner.
2. Motor failure of any motor component directly attributable to materials and/or workmanship within three (3) years after substantial completion shall be repaired or replaced by the pump manufacturer at no cost to the Owner.

PART 2 - PRODUCTS

2.1 END SUCTION, CENTRIFUGAL PUMPS

A. General

1. Pump performance shall be optimized with provision of variable speed drives where designated in the drawings.
2. Operational Pump Characteristics

3. Engineer has the right to reject any pump with a pump curve having a design point operating efficiency more than 5% below the operating efficiency of the scheduled pump provided on the drawings.
4. Furnish and install horizontal close-coupled end suction centrifugal pumps as specified on the Contract Drawings or as pre-approved by the Architect/Engineer.

B. Materials of Construction:

1. Flooded Suction Pumps
   a. Pump internal materials shall be as follows:
      1) Casing – Cast Iron (ASTM A48)
      2) Impeller – Bronze (ASTM B584) with maximum zinc content of 5%
      3) Case Wear Ring – Bronze (ASTM B62)
      4) Shaft – Hardened Steel (AISI 1045)
      5) Shaft Sleeve – Bronze (ASTM B62)
   b. Coating: All wetted ferrous parts and the pump impeller shall be sandblasted per the coating manufacturer's recommendations and coated with Scotchkote 134 or equal product.
   c. Casing
      1) The casing will be of the end suction design with tangential discharge outlet. For suction piping diameters of 2" or greater, the suction inlet shall be a flat-faced flange connection and the discharge outlet shall be a bolt through flange connection. Flange connections shall be ANSI 125# rated.
      2) The casing shall have tapped and plugged holes for priming and draining. The casing bore shall be large enough to allow "back pullout" of the impeller without disturbing the casing or suction and discharge piping. The casing shall be supported by the driving unit. Pumps requiring a mounting point other than the driving unit shall not be allowed.
   d. Impeller: The impeller shall be of the enclosed type, vacuum cast in one piece. It shall be finished all over, the exterior being turned and the interior being finished smooth and cleaned of all burrs, trimmings and irregularities. The impeller shall be dynamically balanced. The impeller will be keyed to the shaft, and fastened with 316 stainless steel washers, gasket and cap screw.
   e. Case Wearing Ring: The pump casing shall be fitted with a bronze case wear ring to minimize abrasive and corrosive wear to the casing. The case wear ring shall be of the radial type, press fitted into the casing.
   f. Mechanical Seal: Shaft sealing shall be accomplished by means of a John Crane Type 21 or equal mechanical seal with solid silicone carbide face/primary ring; solid silicone carbide seat/mating ring; 316 stainless drive band, retainer and spring; and Buna-N elastomers.
   g. Shaft: The impeller shall be direct coupled to the motor shaft. The motor shaft shall be machined to provide a key way and drilled and tapped to accept the impeller fastener. Stub shafts are not acceptable.
   h. Shaft Sleeve: The pump shaft shall be fitted with a bronze shaft sleeve to minimize shaft wear. The sleeve shall be sealed to the impeller hub by an 0-ring and shall be positively driven by a pin to the key way. The use of adhesive compounds to fasten the sleeve to the shaft shall not be accepted.
   i. Motor
      1) The motor shall be a NEMA-JM configuration motor meeting current NEMA Premium Efficiency Standards and shall be totally enclosed fan cooled (TEFC). NEMA –JP configurations shall not be allowed due to shaft overhang.
      2) The motor shall have a service factor of a least 1.15. The service factor is reserved for variations in voltage and frequency.
      3) Motor must be rated for use with a Variable Frequency Drive and meet the NEMA MG1 Standard, Part 30.
      4) The motor shall have a sufficient horsepower rating to operate the pump at any point on the pump's head capacity curve at full load speed (60 Hz) regardless of selected operating speed without overloading the nameplate horsepower rating of the motor, regardless of service factor. Vendor shall confirm that motor current

does not exceed allowable full load amperage at reduced frequency. Vendor shall verify scheduled horsepower meets above requirements. In no case shall the horsepower be less than indicated on the Drawings without specific approval from the Engineer.

5) Electrical requirements including phase, frequency, and voltage are indicated on the Drawings.

2.2 PUMP ACCESSORIES

A. Pump Strainers

1. All Horizontal Pumps
   a. Unless the pump has an integral hair and lint strainer, supply and install strainers equal to those indicated on the Contract Documents.
   b. Provide each strainer with two strainer baskets.

B. Gauges

1. Provide compound gauges where called for on Drawings and as required by Code.
2. Compound gauges shall be Liquid Filled, 30 Hg to 60 PSI with gauge cock and snubber as manufactured by Weksler, Marsh, Winters or equal.

C. Flowmeters

1. Provide flow meters where called for on the Drawings and as required by Code on main lines and on branch lines of flow ranges indicated.
2. Flowmeters shall be as specified on the contract documents or approved equal.

D. Pump Labels

1. Provide corrosion-resistant, permanent pump labels with contrasting lettering.
2. Label shall include pump ID from contract drawings and a description. (e.g. P1A Lap Pool Filtration Pump")

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. The pumping units shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings by the Pool Engineer.

B. Ensure that the pumps and motors are properly supported and aligned with no pipe strain transmitted to the pump casing.

C. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

D. Permanently affix pump label to the pump.

3.2 ACCESSORY INSTALLATION

A. install accessories as shown on the contract documents and in accordance with manufacturer's instructions.

B. Strainers shall be supported on a concrete housekeeping pad and provided with sufficient space for maintenance.

C. Gauges shall be positioned to be read adjacent to the pump or from above, where pumps are in a pump pit.

D. Permanently affix pump label to the pump in an easily visible location.

3.3 FACTORY TRAINED REPRESENTATIVE

A. Provide a factory-trained representative for the purpose of supervising installation, start-up, final field acceptance testing, and providing instruction to the owner's operating personnel in the proper operation and maintenance of the equipment in this section.

B. Contractor and factory-trained representative shall verify pump flow aligns with the pump curve and calibrate flowmeter as required.

END OF SECTION 13 1125

SECTION 13 1132 - POOL FIBERGLASS FILTERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pool Fiberglass Filters

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 REFERENCES

A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.
   1. National Sanitary Foundation (NSF)
   2. ASTM D-2150 – Specification for Woven Roving Glass Fabric for Polyester

1.4 DESIGN REQUIREMENTS

A. As assurance that each item of apparatus is properly sized to perform in conjunction with each other, the Owner requires bidders to use the filter manufacturer as a single source of supply for the items of equipment as listed and described herewith.

1.5 SUBMITTALS

A. Provide detailed Shop Drawings of the items of equipment being provided, indicating the dimensions, material and characteristics of the filter shells, interior and exterior filter manifolds, nozzle system and filter media.

B. Provide a typed sheet of Operating Instructions, embracing the operation functions and recurring maintenance processes involved in connection with the complete filtration system.

1.6 CERTIFICATIONS

A. Shall bear the NSF Seal of Approval, Standard #50 for sand type filters.

1.7 QUALIFICATION STATEMENTS

A. The equipment described herein shall be a product of a manufacturer regularly engaged in the fabrication of fiberglass pressure vessels for at least fifteen years.

1.8 WARRANTY

A. The equipment supplier shall guarantee that the equipment to be furnished is of the correct capacity, that the various parts are designed to operate correctly and in conjunction with each other, that if the installation is made in accordance with his drawings and operated in accordance with his instructions, the system will perform the prescribed functions correctly, the water entering the pool will be clear, bright, free from suspended matter visible to the unaided eye, will not produce any toxic effect or impart undesirable taste, odors or colors, and will be sanitary to the satisfaction of all authorities having jurisdiction.

B. Provide a fifteen-year non-prorated warrantee.

1.9 SYSTEM STARTUP

A. An authorized representative of the equipment supplier shall provide the supervisory services of an Installation Engineer for at least one day to fully instruct designated personnel in the operation, care and maintenance of the filter system.

PART 2 - PRODUCTS

2.1 FILTERS

A. Fiberglass Filter Tank

1. The filter tank shall be no less diameter and length than shown on plan. It shall be suitable for 50 psi working pressure and hydrostatically tested to 75 psi.
2. Two saddle style bases shall be provided for tank support. Systems that incorporate stacked tanks shall include similar bases and mounting saddles for the upper vessel. Access to the tank shall be provided by a 14" x 18" manhole with two fiberglass curved yokes. Manhole seal shall 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 will be allowed.
3. Drain out system shall consist of one 3/4" coupling mounted to the tank bottom. One 3/4" coupling shall be provided for the air relief connection.
4. Each filter tank shall be equipped with the necessary flanges and connections for the internal and external piping. Connections shall be comprised of fiberglass flanges and schedule 80 PVC flanges.
5. The resin used shall be a commercial grade, premium corrosion resistant vinyl ester that has been evaluated in a laminate by test in accordance with ASTM C-581 in service comparable to the intended service and recommended for this service by the manufacturer.
6. A thixotropic agent that does not interfere with visual inspection of laminate quality shall only be added for viscosity control in resins that are not to be used in the inner corrosion barrier, interior layers, interior secondary layers, and interior top coats.
7. Resin pastes used to fill crevices may contain thixotropic agents provided that all such areas are subsequently covered with a full corrosion resistant barrier laminate.
8. Ultraviolet absorbers shall be added to the exterior surface for improved exterior resistance.
9. Chopped strand mat shall be constructed from commercial grade E-type glass strands bonded together using a binder. The strands shall be treated with a sizing that is chemically compatible with the resin system used.
10. Continuous roving shall be a commercial grade of E-type glass fiber with a sizing that is chemically compatible with the resin system used. Continuous roving for chipping in spray-up process shall be principally silane furnished with as little chrome compounds as practical to achieve chipper performance while maintaining visual laminate clarity requirements.
11. Woven roving shall be in accordance with ASTM Specification D-4357.
12. The laminate comprising the structural tank (cylindrical shell) shall consist of a corrosion-resistant barrier comprised of an inner surface, interior layer and a structural layer.
13. The inner surface exposed to the chemical environment shall be a resin rich 0.010 to 0.030 inches thick, reinforced with 1 ply of continuous glass fiber surface mat such as Regina/OCF C3/33 or approved equal.
14. The inner surface exposed to the corrosive environment shall be followed with a layer composed of resin, reinforced only with non-continuous glass fiber strands applied to a minimum thickness of 0.100 inches. The combined thickness of the inner surface and interior layer shall be 0.110 to 0.130 inches and in no case less than 0.100 inches.
15. The glass content of the inner surface and interior layer combined shall be 27% & 5% by weight.
16. Resin used in these layers shall be Hetron 922 incorporating a Cobalt/MEKP cure system as recommended by the manufacturer.
17. The degree of cure shall be such as to exhibit a Barcol hardness on the inner surface of at least 90% of the resin manufacturer's minimum specified hardness for the cured laminate with a continuous glass surface mat.

18. Subsequent reinforcement shall be continuous strand roving as is needed to satisfy the design requirements. Glass content of this filament-wound structural layer shall be 50 to 80% by weight. Only those constructions evaluated for design properties shall be used.
19. Subsequent reinforcement shall be comprised of 1.5 oz./ft. chopped strand mat or equivalent weight of chopped roving, or shall be comprised of chopped strand mat or chopped roving, and such additional number of alternating plies of 24 oz./yd. woven roving to a thickness as required to meet the physical properties that are used for the design. Each successive ply or pass of reinforcement shall be well-rolled prior to the application of additional reinforcement. Where woven rovings are used, chopped strand glass reinforcement shall be used as alternating and final layers. All woven roving and chopped strand shall be overlapped. Laps in subsequent layers shall be staggered at least 2.25 inches from laps in the preceding layer.
20. Resin used in the structural layer shall be the same as used in the inner surface and interior layers. Other generic types of resin such as isophthalics or general-purpose resins shall not be used.

B. Valve Control Assembly:

1. A mechanical linkage constructed of T304 stainless steel shall connect two valves in order to create simultaneous movement.
2. Assembly shall be designed so that filter and backwash cycles can be accomplished by repositioning two pairs of valves.
3. Each pair of valves shall be easily moved by one master handle mechanism that will provide accurate propositioning for tight shut off.

2.2 FILTER MEDIA

A. Gravel support media of a hard coarse aggregate with a subangular grain shape with a particle size of 1/8" x ¼" shall be used. The specific gravity shall not be less than 2.5. Place support media by hand to avoid damage to the underdrain system and level before the addition of the upper layer of filter media. Concrete underfill shall not be used. Media shall be free from minerals that may precipitate onto pool surfaces.

B. Sand shall be a carefully selected grade of hard, uniformly graded silica material. Media shall be naturally rounded particles of silica or milled angularly shaped particles of silica quartz. Sand shall have a particle size between .45 mm and .55 mm (#20). No more than 1.5% shall be allowed to pass through a #40 sieve (.0164"). Uniformity coefficient shall not exceed 1.53. Specific gravity to be not less than 2.5. Media shall be free from minerals that may precipitate onto pool surfaces.

C. Each filter tank shall be provided with media as required per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 FILTER SYSTEM

A. Provide installation complete with factory representative training and equipment start.

B. Pool Contractor shall deliver four complete sets of operating and maintenance instructions for operation, maintenance and cleaning of Filter system.

C. Training and Start-Up

1. Filter installation shall include a filter system "start-up" and "system operator training (SOT)". Start-up shall include the first-time use of the filter in recirculation position and all system adjustments as needed for proper operation of all filter positions. SOT shall include written and verbal instructions and demonstrations required for the system operator to properly operate and maintain the filter system in all filter operating modes.

2. Start-Up and SOT shall be completed by a fully trained and authorized filter manufacturer representative.
3. Prior to initiating the Start-Up procedures, the contractor shall complete all equipment installation and tests as required for proper filter operations. Contractor shall obtain the "Pre-Start-Up" requirements/checklist directly from the filter manufacturer.
4. Contractor shall coordinate and schedule the system start-up and training directly with the filter manufacturer and Owner.
5. SOT session shall be a minimum of one (1) day duration. Obtain written documentation with a dated signature from the system operator that training was provided to their satisfaction.

END OF SECTION 13 1132

SECTION 13 1135 - POOL ULTRAVIOLET DISINFECTION EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pool ultraviolet disinfection equipment for future install.

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 REFERENCES

A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.

1. NSF – National Sanitary Foundation
2. MET – Met Laboratories, Inc.
3. CSA – Canadian Standards Association
4. UL – Underwriters Laboratory
5. NEMA – National Electrical Manufacturers' Association
6. ANSI – American National Standards Institute
7. USEPA UVDGM- U.S. Environmental Protection Agency Ultraviolet Guidance Manual
8. Din- German Institute of Standardization
9. IP- International Electrotechnical Commission

1.4 SUBMITTALS

A. Drawings and Instructions

1. Provide detailed Shop Drawings of the items of equipment being provided, indicating the dimensions, material and characteristics.
2. Provide a detailed Operations Manual, embracing the operation functions and recurring maintenance processes.

1.5 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to General Requirements and Division 01.

1.7 WARRANTY

A. A factory trained representative of the manufacturer shall perform all warranty work. Manufacturer to warranty Ultraviolet chamber and Spectra Touch Control panel for a period of 5 years (see requirements) excluding lamps, quartz and seals. Medium pressure Ultraviolet bulbs shall be warranted for a period of 8,000 hours. Intermittently operated lamps (≥ 1 on/off cycles per day) will be replaced free of charge should failure occur prior to 4,000 hours and replacement will be prorated between 4,000 and 8,000 hours.

B. Manufacturer must maintain spare or replacement parts in the USA for same day or no longer than next day delivery in North America, other areas based on expedited delivery available.

C. A Service Agreement (twice per year maintenance) from a qualified factory certified distributor shall be provided to initiate the service to maintain the five-year warranty.

PART 2 - PRODUCTS

2.1 GENERAL

A. Ultraviolet Disinfection Equipment: Shall operate within the UVC electromagnetic spectrum emitting wavelengths in the range of 200nm to 400nm. This required wavelength will provide constant disinfection/inactivation of bacteria, algae, molds, viruses and destruction of Monochloramines, Trichloramines, and Dichloramines. Ultraviolet Lamp/Chamber and Spectra Touch Control Panel by ETS UV by Neptune Benson (Telephone 920-885-4628, Fax 920-885-4386) or Architect/Engineer approved equal. Any deviation/exception must be provided in writing to and approved by the designer prior to the bid date.

B. The UV System shall have an MET or equivalent (ETL, CSA, or UL) listing, be NSF-50 2016 certified including Section 14.18 (crypto inactivation) and 3rd party validated to the USEPA UVDGM 2006 Guidelines.

1. Equipment General Description
   a. The Ultraviolet System shall be provided in a complete package to include: 316L Schedule 10 Stainless Steel Chamber, Spectra Touch Control System located in a NEMA 12 (IP52) rated panel, Medium Pressure Bulb(s) designed to emit wavelengths within the UVC electromagnetic spectrum, UV EZ Clean strainer, automatic wiper system, and Project Commissioning by a Certified ETS Ultraviolet Technician.

2.2 UNIT TYPES

A. ECF Units: Ultraviolet manufacturer to offer unit capability of a horizontal OR vertical installation application using state of art design and direct flow through characteristics. Direct flow will be required in order to reduce total head loss through the system. Unit shall be a Multiple Lamp medium pressure system with a bulb range of (2) 1.0 kW – (4) 3.0 kW power range. Multiple lamp system is required in order to maintain quality disinfection in the event of a single bulb failure. ANSI or PN (as specified) flange range of 4"/100MM – 12"/300MM and flow pattern of 350 to 3700 GPM (79 m3/hr to 840 m3/hr) @ 94% UVT. Any systems validated or designed for flows based on 98% UVT are not acceptable. Chamber and Control Cabinet shall be as indicated on the drawings. Electrical requirements to include either of the following 208, 240, 315, 400, 415, 480 or 575 volt 3-phase 50/60 HZ (as specified) with a (XX) amp external breaker recommended by ETS based on the appropriate supply voltage. The electrical contractor is to take into account plus/minus 3% for external breaker. All required electrical work to be performed by licensed electrician.

2.3 ULTRAVIOLET CHAMBER

A. Pressure rated for 100 psi/8 Bar (tested to 150 psi/11 Bar), and pressure drop across the unit will be minimal. The unit shall be constructed of 316L stainless steel, schedule 10 pipe, passivated to prevent corrosion within the harsh pool environment. The Ultraviolet chamber shall come complete with the following equipment.

B. Ultraviolet intensity monitor factory calibrated to provide intensity in mw/cm2, monitors providing percentage of lamp output not acceptable. It must include a built-in alarm system to notify operator when output level drops below required level of 60 mj/cm2 for indoor pools or 40mj/cm2 for outdoor pools (or operator set dosing levels).

C. Ultraviolet temperature control system shall be provided to maintain system integrity in the event of flow interruptions to the chamber.

D. Ultraviolet chamber shall come complete with annealed quartz sleeve with "O" ring seals for water tightness.

E. Chambers shall be complete with ANSI or DN flanges (as specified) and all ports or vents shall be threaded NPT. The Ultraviolet chamber must be capable of installation in the system so that it remains full under all conditions.

F. The ultraviolet unit must be complete with integrated brackets or feet for ease of installation in either vertical or horizontal mounting.

G. The Chamber shall have a sacrificial anode attached to the chamber, extending inside the chamber and be bonded to the installation bond loop.

2.4 ULTRAVIOLET LAMP

A. Ultraviolet lamp shall be medium pressure high intensity. Lamp shall be designed to emit continuous Ultraviolet wavelengths in the range of 200nm to 400nm. This will provide optimal disinfection benefits and destruction of the Monochloramine, Dichloramine, and Trichloramine compounds. Lamp must remain unaffected by temperature variance of 0 degrees Fahrenheit (-17 degrees Celsius) to 200 degrees Fahrenheit (93 degrees Celsius).

B. The lamp system must provide a constant dose of not less than 60 mj/cm2 until the end of the lamp life for indoor applications and not less than 40 mj/cm2 for outdoor disinfection and this must be based on constantly monitoring the full recirculating flow rate, not on a side stream treatment. The system must be equipped with variable power control to control the intensity & dose of the lamp in 1% increments. Power stepping not acceptable.

C. The lamp(s) must be powered by chokes. Electronic ballasts are not acceptable since they limit the distance between the chamber and the power supply to 13 feet (4M) to operate effectively and must be replaced every two to three years.

2.5 AUTOMATIC WIPER SYSTEM

A. An automatic cleaning system shall be provided for cleaning of quartz sleeve and Ultraviolet monitor probe. The system shall travel the entire length of the quartz sleeve twice per desired cleaning cycle. Precision molded wiper rings shall be provided to ensure thorough quartz tube cleaning and quartz tube protection. Wiper cycle shall be user selectable and adjustable within a range of 5 minutes to 24 hours depending on anticipated application and deposit build-up. At a minimum, the Automatic Wiper system shall have the following characteristics:

1. System shall utilize direct Belt Drive with square machined pulleys and acme threaded shaft to prevent slippage and pin shearing. Systems utilizing shear pins or complicated gear boxes will be unacceptable.
2. Wiper power supply shall be 24-volt DC for improved safety. Higher voltage not acceptable.
3. System shall incorporate Direct Shaft Encoding for positional location. Systems relying on external limit switches or internally located magnets will be unacceptable.
4. Wiper interval shall be operator selectable with optional override switch.
5. Wiper faults are to be indicated on the control system display.
6. Wiper System to utilize "Intelligent Operation" for automatic start-up commissioning.
   a. Records wiper position at chamber ends. Position must be fixed and not dependent on a timed interval or component striking end of chamber.
   b. Establish a travel run without setting limit adjustments to ensure system integrity and longevity.

2.6 UV STRAINER

A. The UV system must be provided with a downstream strainer to protect against the remote possibility of lamp /quartz breakage traveling downstream.

B. The strainer must be cleanable without removal from the piping system.

C. The strainer must be operable either manually, electrically or pneumatically to clean it.

D. The electrical or pneumatic operation must be able to be integrated with the filtration control system and/or the UV control system.

2.7 ULTRAVIOLET CONTROL SYSTEM

E. Control cabinet shall be an ETS SPECTRA Touch control unit and or pre-approved equal. The cabinet shall be an epoxy coated NEMA 12 / IP52 rated cabinet. If mounted outdoors it must be a NEMA4X /IP56 rated cabinet with an integral A/C unit to protect the components from the environment. The power must be controllable to provide full power, half power and infinite variable power based on real time interface with changes in UVT, Flow Rate or Combined Chloramines. The power panel must house the chokes required to ignite the lamps. Three levels of operation shall be provided to meet the needs of the operator and pool environment: Simple Control (start, stop and reset), Full Parameter Display, and Customized Operator Configuration. Modes of operation shall be password protected to secure system critical setup functions. Touch Control system shall have clearly identifiable start, stop, and reset icons (suitable for gloved operation) with Running and Fault LCD indicators.

1. The main Touch screen shall display a minimum of the following: Ultraviolet calculated dose (derived from flow and intensity inputs), Ultraviolet intensity (as a % and mw/cm2), Lamp Current, Flow rate (accepts signal from optional flow meter – displayed as gallons per minute or m3/hour), Chamber temperature (displayed as deg. F or deg. C), Operation hour meter, and fault indicators to include Lamp fault, low Ultraviolet & temperature alarm, Ground fault trip, Wiper fault. All alarm functions shall have simple text message display to assist in fault finding.
2. Touch Control system shall have a minimum of the following system interface control: Remote operation, Process interrupt features (from valves, flow meters), Low UV dose (configurable to shutdown or alarm only), Flow meter input, Auto-Restrike, Half to full power Ultraviolet setting with 24-hour/7-day settable timer. Variable power/Dose pacing interface.
3. Touch Control system shall have built in data-logging capabilities to record the following information: Ultraviolet intensity required, Ultraviolet intensity measured, Lamp current, Chamber temperature, Flow rate (if flow meter is connected), Time and date stamp, all alarms generated.
4. Touch Control system must be able to be interfaced with a Chemistry Controller that can measure Total or Combined Chloramines in order to maintain the proper dosage required during the life of the lamp.
5. Touch Control System must be able to interface with the Defender filtration controller.
6. Touch Control System must be capable of operating through Ethernet or Wi Fi.
7. Touch Control System must be capable of interfacing with a SCADA system including both Profibus and Modbus.
8. The Control System shall have an audible alarm that interlocks the pump VFD and the UV controller. Provide alarm, connections for interlocking, power as needed, and connect per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 SYSTEM STARTUP

A. Install in accordance with contract documents and manufacturer's instructions.

B. Commissioning
1. Ultraviolet Chamber and Control Panel shall be commissioned by a qualified factory trained technician to institute the warranty.
2. Final electrical and control cabling will be connected from the Touch control cabinet to the Ultraviolet disinfection chamber during the commissioning process.

3. Daily operation and simple maintenance instructions shall be provided during the commissioning process.
4. SOT shall be conducted only by a factory trained technician.

END OF SECTION 13 1135

SECTION 13 1137 - POOL CHEMICAL SYSTEMS & CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Chemical Controller with the following sensors:

1. pH Sensor
2. ORP Sensor
3. Temperature Sensor
4. Flow Sensor

B. Free Chlorine Sensor

C. Total Chlorine Sensor

D. Pool Surge Level Sensor

E. Calcium Hypochlorite (Accu-Tab) Feeders

F. Sodium Bisulfate (Acid-Rite) Feeders

G. Calcium Hypochlorite Storage Buckets

H. Sodium Bisulfate Storage Buckets

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 QUALITY ASSURANCE

A. The controller shall carry the following product certifications:

1. NSF Standard 50
2. UL 61010-1

1.4 SUBMITTALS

A. Refer to General Requirements and Division 01.

B. Submittals required: For each type of manufactured material and product indicated. Provide Submittals indicating equipment provided, dimensions, material specifications, wiring diagrams and all accessory components including sensors.

1.5 SUBSTITUTIONS

A. Refer to General Conditions, Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to General Conditions, Division 01.

1.7 WARRANTIES

A. Controller shall be covered by manufacturer's 5-year warranty.

B. ORP and pH sensors shall be covered by manufacturer's 2-year warranty.

C. Other sensors and flow cell components shall be covered by manufacturer's 1-year warranty.

D. Chemical feed pumps shall be covered by manufacturer's 2-year warranty.

E. A factory trained/authorized representative shall provide training to the owner. The control system shall be provided with on-site start-up, on-site operator training, and 1-year on-site warranty service performed by a representative trained and authorized by the controller manufacturer.

PART 2 - PRODUCTS

2.1 All products listed as basis of design are acceptable, as are approved equivalents by Project Manager.

2.2 CHEMICAL CONTROLLER

A. The water chemistry control system shall provide continuous monitoring and control of the water chemistry and related disinfection equipment.

1. The controller shall continuously monitor and control pH. Chemical feed shall be configurable for manual, automatic, proportional, and on/off modes.
2. The controller shall continuously monitor, and control sanitizer based upon the ORP reading, the free chlorine sensor, or both. Chemical feed shall be configurable for either on/off or time-based proportional feed.
3. The controller shall have a programmable superchlorination function, based upon ORP or ppm superchlorination setpoint, which is triggered manually.
4. The controller shall have a programmable dechlorination function, based upon ORP or ppm dechlor setpoint, which is triggered either manually or by the completion of the superchlorination function.
5. The controller shall compute the Langelier Saturation Index and the Ryznar Saturation Index based upon sensor data and/or manual entered by the operator.
6. The controller shall continuously monitor, display, and datalog system flow, maintaining a total flow volume. A Low Flow Alarm shall be operator settable, which can be programmed to disable chemical feeds.
7. The controller shall control the boost function for a UV dosing based on real-time combined chlorine as calculated by the readings from an amperometric free chlorine and total chlorine sensor.
8. The controller shall also have a Minimum Flow Rate setting to turn off heater whenever system flow is less than this programmed minimum level. The controller shall also manage the heater on/off status based on real-time water temperature reading.
9. The controller shall monitor TDS (total dissolved solids). The controller shall provide selectable control of TDS through simultaneous draining of water prior to filtration and addition of fresh make-up water.
10. The controller shall continuously monitor, display, and data log pool or surge tank level. The controller shall automatically control a water makeup relay to add makeup water to maintain pool level set point based on pool or surge tank level.

B. The standard display shall be a backlit transflective LCD that will continuously display information related to the following:

1. All installed sensor readings

2. Set points, with current control status
3. All active alarms, including time activate

C. The flow sensor shall be used to prove flow to the chemical controller to prevent dosing of chemicals during a system low flow/no flow condition.

D. The controller shall automatically abort a Manual or Scheduled Turndown upon declining water chemistry and return to the standard programmed circulation rate to maintain optimal water quality. Declining water chemistry is signaled by any of the alarm conditions.

E. The controller shall signal all alarm conditions with the following indicators:

1. A bright flashing LED on the front of the controller.
2. Each active alarm listed on the LCD display along with time activated.
3. Email and text alarm notifications.

F. The controller inputs are as follows:

1. The controller shall have inputs available for pH, ORP, Temperature, free chlorine, and flow sensors.
2. The controller shall come with a minimum of (3) fully assignable digital inputs available for items other than those listed above.

G. The controller outputs are as follows:

1. The controller shall have integral line or dry contact 5A solid-state relay outputs capable of switching 3A under all normal operating conditions available for Acid feed and sanitizer feed pumps.
2. The controller shall come with a minimum of (2) fully assignable integral line or dry contact 5A solid-state relay outputs capable of switching 3A under all normal operating conditions available for items other than those listed above.
3. All relays must account for the effects of the temperature gradient inside the IP66 or NEMA 4X enclosure. Systems that utilize relays that are not de-rated must submit an engineering evaluation justifying the use of relays at their full, optimal-condition capacity. All solid-state relays shall have a provision for an electrical interlock with the circulation pump motor starter.
4. The controller shall come with a minimum of (8) separately isolated 4-20mA output signals.
5. The controller shall be capable of expanded capabilities with optional expansion package.

H. Required controller safety features:

1. The controller shall have built-in limits to the amount of time any relay control output may be forced on (i.e. in "Manual On" mode).
2. The controller shall have programmable high and low alarm settings for pH, ORP, PPM, temperature, low flow & no flow and chemical overfeed. The controller shall have a programmable lockout of sanitizer feed upon pH high or low alarm.
3. The controller shall activate a No Flow alarm when the dedicated sample stream flow switch indicates there is insufficient flow through the sample stream. This No Flow alarm shall lockout all chemical feed control operations.
4. The controller shall have a dedicated Emergency Off button on the front panel of the system, which immediately halts all chemical feeds and control outputs when pressed. This feature shall require entry of a security access code.

I. Required controller remote communication and access features:

1. The controller shall have the ability to allow field upgrades and updates and programming as needed. Controller must be capable of being accessed via remote communication.

2. The controller shall have a means to preserve data logs during power outages, for input level recording and events. All input levels shall be recorded and maintained for 365 days on the controller, with a sample taken every minute. The controller shall record and maintain the events over the last 365 days recording all alarms, parameter changes, user logins, and operational cycles related to all control features.
3. The controller shall also support the following types of connection to 3rd party applications such as EMS, BMS, BAC and SCADA systems:
   a. 1) MODBUS TCP/IP
   b. MS/TP (RS485)
   c. TCP/IP (Ethernet) BACnet connection
      The connection shall support access to Inputs (current readings), System Information, Set Points, Alarm Points, Control Status and Alarms. Set Points and Alarm Points shall be modifiable from the 3rd party application via the selected interface.
4. The controller shall come with an integral Wi-Fi module.
5. The controller shall be Windows 10 compatible or include the necessary software and apps to allow for the real-time monitor/ of the following via personal computer, smartphone, or tablet device:
   a. Auto-Polling – to allow automatic download of data logs.
   b. Graphical Operator's Console – to display current readings, setpoints, alarm points and control status mode.
   c. Data Logging
   d. Email and text alarms notifications.
6. The controller shall require security access codes.

J. The controller shall be housed in an IP66 or NEMA 4X polycarbonate enclosure. All high-voltage wiring shall be performed in a separate IP66 OR NEMA 4X enclosure that precludes access to the controller electronics.

2.3 pH SENSOR

A. The controller shall provide a measurement of pH by utilizing a sensor with the following characteristics:

1. 2 – 12 sensing range
2. operating temperature range of 32-140 °F (0-60°C)
3. operating pressure range of 0 - 60 psi (0 TO 4.1 bar)
4. The controller shall continuously monitor, display and data log pH with minimum 0.1 resolution.

2.4 ORP SENSOR

A. The controller shall provide a measurement of ORP by utilizing a sensor with the following characteristics:

1. 0 to 999 mV sensing range;
2. operating temperature range of 32- 140° F (0-60°C)
3. operating pressure range of 0- 60 psi (0 TO 4.1bar)
4. The controller shall continuously monitor, display and data log ORP with minimum 6mV resolution.

2.5 TEMPERATURE SENSOR

A. The controller shall provide a measurement of water temperature by utilizing a sensor with the following characteristics:

1. 32 – 212°F (0 – 100°C) sensing range
2. Operating temperature range of 32 – 212°F (0 – 100°C)

3. Operating pressure range of 0-145 psi (0-10 bar)
4. The controller shall continuously monitor, display and data log temperature with 5/9 °C (1°F) resolution.

2.6 CIRCULATION FLOW SENSOR

A. The controller shall provide a measurement of pool circulation flow rate and volume by utilizing a flow sensor with the following characteristics:

1. paddle wheel flow sensor
2. O-ring seal
3. The controller shall continuously monitor, display and data log flow rate with 0.45 lpm (0.1 gpm) resolution.

2.7 FREE CHLORINE SENSOR

A. The controller shall provide a measurement of free chlorine by utilizing a sensor with the following characteristics:

1. 0.0 to 10.0 mg/l (ppm) measuring range
2. 32° - 176°F (0°-80°C) operating temperature range
3. Replaceable cleaning beads
4. The sensor shall not utilize a membrane or electrolyte. Sensors utilizing a membrane and/or electrolyte, which must be replaced and/or replenished on a regular basis, shall not be considered equal. The controller shall continuously monitor, display and data log free chlorine with 0.1 mg/l resolution.

2.8 CHLORINE READING

A. The controller shall provide measurement of total chlorine utilizing a sensor with the following characteristics:

1. 0.0 to 10.0 mg/l (ppm) measuring range
2. (41° - 113°F) 5°-45°C operating temperature range
3. Operating pressure range 0-44 psi (0-3 bar)
4. replaceable membrane and electrolyte
5. The controller shall continuously monitor, display and data log total chlorine with 0.1 mg/l resolution. The controller shall also continuously monitor, display and data log combined chlorine (from the total chlorine and free chlorine sensors) with 0.1 mg/l resolution.

2.9 AUTO-FILL WATER LEVEL SENSOR

A. The controller shall provide a measurement of the water level by utilizing a continuous level sensor with the following characteristics:

1. Field configurable sensor length,
2. Installation options for wall mount and stand pipe glass configurations.
3. 4 to 20 mA output
4. The controller shall continuously monitor, display and data log the water level with 10 mm (0.4") resolution or better. The controller shall use the sensor to control a water makeup valve to maintain water level (Autofill) and/or control a main drain modulating valve.

2.10 SOLID CHLORINE (CALCIUM HYPOCHLORITE) FEEDER

A. All calcium hypochlorite tablet chlorination systems shall be of the size and meet the output requirements indicated on the construction documents, meet all state and local code requirements, and shall meet the following criteria:

1. Self-priming booster pump.
2. 32-125° F (0-52°C) operating temperature range
3. Operating pressure range: 0-25 psi (0-1.7 Bar)).
4. Required suction lift: 25' (7.6 M) at sea level.
5. Pump: Centrifugal Booster Pump AC Motor, 120v, 1 phase, 20 A.
6. Chemical Controller Solenoid: Separate connection for solenoid operation to be connected to chemical controller. Controller relay for control of valve to be 120v, 1 phase
7. Plumbing: All plumbing to be hard PVC piping for size shown in the manufacturer instructions.
8. Chemical compatibility: All components of feed pump must be resistant to Calcium Hypochlorite at 76% Maximum Strength.

B. Manufacturer:
   1. Accu-Tab

2.11 SOLID ACID (SODIUM BISULFATE) FEEDER

A. All calcium hypochlorite tablet chlorination systems shall be of the size and meet the output requirements indicated on the construction documents, meet all state and local code requirements, and shall meet the following criteria:
   1. Self-priming booster pump.
   2. 32-125° F (0-52°C) operating temperature range
   3. Operating pressure range: 0-25 psi (0-1.7 Bar)).
   4. Required suction lift: 25' (7.6 M) at sea level.
   5. Pump: Centrifugal Booster Pump AC Motor, 120v, 1 phase, 20 A.
   6. Chemical Controller Solenoid: Separate connection for solenoid operation to be connected to chemical controller. Controller relay for control of valve to be 120v, 1 phase
   7. Plumbing: All plumbing to be hard PVC piping for size shown in the manufacturer instructions.
   8. Chemical compatibility: All components of feed pump must be resistant to Sodium Bisulfate from 60% to 100% Maximum Strength.

B. Manufacturer:
   1. Acid Rite

2.12 SOLID CHLORINE (CALCIUM HYPOCHLORITE) STORAGE BUCKETS

A. All solid chlorine buckets shall be of the size indicated on the construction documents and shall be in buckets that able to be transportation buckets. Buckets shall be completely sealed after use and stored per in amounts per local code. Operation and handling shall be per instructions of manufacture of chemical and operator shall follow those recommendations.

B. Manufacturer:
   1. Accu-Tab

2.13 SOLID ACID (SODIUM BISULFATE) STORAGE BUCKETS

A. All solid acid buckets shall be of the size indicated on the construction documents and shall be in buckets that able to be transportation buckets. Buckets shall be completely sealed after use and stored per in amounts per local code. Operation and handling shall be per instructions of manufacture of chemical and operator shall follow those recommendations.

B. Manufacturer:
   1. Acid Rite

PART 3 - EXECUTION

3.1 CHEMICAL CONTROLLER INSTALLATION

A. Installation of the system shall be per the manufacturer's specification and no exceptions shall be allowed. A factory trained/authorized representative shall provide training to the owner. The control system shall be provided with on-site start-up, on-site operator training, and 1-year on-site warranty service performed by a representative trained and authorized by the controller manufacturer.

B. Calibration of chemical controller shall be executed only after the monitored pool temperature has been established to within 4 degrees of the design temp, or as required by the manufacturer's installation instructions, if more stringent.

3.2 CHEMICAL STORAGE INSTALLATION

A. Tank shall be hydrostatically tested at time of installation.

3.3 MANUALS

A. Manufacturer shall supply an Installation, Operation and Maintenance Manual describing features, operating instructions, maintenance procedures and replacement parts.

END OF SECTION 13 1137

SECTION 13 1145 - POOL RAIL GOODS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rail Goods
   1. Hand rails
   2. Grab rails
   3. Ladders
   4. Stanchions

B. Accessories
   1. Wedge Anchors
   2. Compression Anchors
   3. Escutcheons

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 REFERENCES

1.4 DESCRIPTION OF WORK

A. Fabrication and installation of hand rails, grab rails ladders, stanchions and accessories required for installations.

1.5 QUALITY ASSURANCE

A. Refer to General Requirements and Division 01 of the Specifications for additional requirements.

1.6 SUBMITTALS

A. Refer to General Requirements and Division 01.

B. Submittals required:
   1. Hand Rails
   2. Grab Rails
   3. Ladders
   4. Therapy Rails
   5. Anchors
   6. Escutcheon Plates
   7. Stanchions
   8. Stanchion Sockets

C. Provide care and maintenance instructions, embracing the operation functions and maintenance processes involved in connection with the complete system, including routine maintenance and cleaning. Provide information regarding maintenance practices and products which may be detrimental to the products.

D. Printed and bound operating, installation, and service manuals.

1.7 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Refer to General Requirements and Division 01.

1.9 WARRANTIES

A. Pool Equipment
   1. Manufacturer's Standard Warranty

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide the equipment scheduled, and any necessary fittings, anchors, and connectors as required and not provided by the manufacturer. The equipment shall be the manufacturer and model number listed or a pre-approved equal. Although unit quantities are shown, it is the installing contractor's responsibility to verify and provide actual quantities required.

B. The following manufacturers have been pre-approved as capable of providing products meeting this specification. Note that custom material/size/finish may be required from some of the manufacturer's listed to meet these specifications.
   1. Spectrum Aquatic, 800-791-8056
   2. SR Smith LLC, 800-824-4387
   3. Paragon Aquatics, 888-KDI-SWIM

2.2 MATERIALS OF CONSTRUCTION

A. Rails
   1. All rail products specified in this section shall be 316L stainless steel.
   2. All rail goods with a grip surface (handrails, grab rails, therapy bars, ladders) shall be 1.50" OD.
   3. Provide rail material with 0.120 wall thickness.
   4. The surface of the rails shall be polished to a minimum 500 grit mirror finish and passivated according to ASTM A967.
   5. Final coating of steel shall be per manufacturer's standard treatment procedure. All welds shall be finished, polished, and passivated to blend and match the rail finish.

B. Stanchions (Backstroke and activity)
   1. All rail products specified in this section shall be 316L stainless steel.
   2. Shall be 1.90" OD, 0.145" wall thickness
   3. The surface of the stanchions shall be polished to a minimum 500 grit mirror finish and passivated according to ASTM A967.
   4. Final coating of steel shall be per manufacturer's standard treatment procedure.
   5. Stanchions shall be 8'-0" tall and provided with a 2" ring on the top surface and a 2" ring on sliding collar.

C. Wedge Anchors
   1. Rail Anchors shall be corrosion resistant, sized to accept the rail dimensions specified and a minimum of 4" deep. For anchors greater than 4" deep, contractor shall verify adequate concrete thickness at the anchor points.
   2. Stanchion Sockets shall be corrosion resistant, minimum 6" deep and designed to accept a 1.90" OD stanchion.

D. Escutcheon Plates
   1. Provide escutcheon plates for each anchor location, sized to match rail diameter.
   2. Shall be rail manufacturer's round, stamped 316L Stainless Steel escutcheon.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manufacturer's Installation Instructions
   1. All equipment of this section shall be installed in accordance with industry standards and comply with manufacturer's installation instructions/recommendation. The contractor shall notify the engineer in writing of any discrepancies between the contract documents and the manufacturer's instruction. This notification shall include a request for clarification prior to installation.

B. Install equipment true and level.

C. Equipment shall be installed secure, with no "play" or movement when shaken.

D. Rails shall be clean, free of dirt and contamination, and polished prior to turnover to owner.

E. Protect Equipment from damage during installation and up to substantial completion. Repair or replace damaged parts.

END OF SECTION 13 1145

SECTION 13 1146 - POOL EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pool Equipment
   1. Pool fittings, deck, maintenance, and safety equipment.

B. Pool Specialty Equipment
   1. Spray and play equipment manufactured for use in swimming pools and/or spray pads.

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 REFERENCES

A. Specialty Equipment

   1. Equipment submitted shall be designed by manufacturer to meet all federal, state, and local requirements.
   2. Equipment manufacturer shall meet applicable requirements of Consumer Product Safety Commission, ASTM, UL, and other applicable standards.
   3. Comply with ASTM F2461-09, standard practice for manufacture, construction, operation, and maintenance of aquatic play equipment.

1.4 DESCRIPTION OF WORK

A. Refer to General Requirements and Division 01 of the Specifications for additional requirements.

1.5 QUALITY ASSURANCE

A. Refer to General Requirements and Division 01 of the Specifications for additional requirements.

1.6 SUBMITTALS

A. Refer to General Requirements and Division 01.

B. Submittals required:

   1. Pool Fittings and Equipment
   2. Deck Equipment
   3. Safety Equipment
   4. Maintenance Equipment
   5. Pool Specialty Equipment
      a. Provide detailed Shop Drawings of equipment being installed, including but not limited to:
         1) Location
         2) Flow rates
         3) Safety equipment

C. Provide a typed sheet of Operating Instructions, embracing the operation functions and maintenance processes involved in connection with the complete system, including routine maintenance, start-up, and winterization requirements.

D. Printed and bound operating, installation, and service manuals.

1.7 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Refer to General Requirements and Division 01.

1.9 WARRANTIES

A. Pool Equipment

1. Manufacturer's Standard Warranty

B. Pool Specialty Equipment

1. Manufacturer's Standard Warranty – 2-year minimum

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide the equipment scheduled on the drawings, and any necessary fittings, anchors, and connectors as required and not provided by the manufacturer. The equipment shall be the manufacturer and model number listed or a pre-approved equal. Although unit quantities are shown for value engineering purpose, it is the installing contractor's responsibility to verify actual quantities required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manufacturer's Installation Instructions

1. All equipment of this section shall be installed in accordance with industry standards and comply with manufacturer's installation instructions/recommendation. The contractor shall notify the engineer in writing of any discrepancies between the contract documents and the manufacturer's instruction. This notification shall include a request for clarification prior to installation.

B. Install equipment true and level.

C. Protect Equipment from damage during installation and up to substantial completion. Repair or replace damaged parts.

END OF SECTION 13 1146

SECTION 13 1161 - POOL CERAMIC TILE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ceramic Pool Tile

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 REFERENCES

A. The following latest edition reference specifications, guides and standards shall become part of this Section as if herein written. If provisions conflict, the more stringent provisions shall apply.

1. ANSI A108 – Specifications for Installation of Ceramic Tile
2. ANSI A137.1 – Tile Grade Requirements
3. ASTM C-150, Type 1 – Portland Cement
4. ASTM C-206, 7 Type S – Hydrated Lime
5. ASTM C-144 - Sand
6. ANSI A118.1 – Dry Set Mortar
7. TCA 759 – Dry Set Mortar
8. ANSI A118.3 – Epoxy Adhesive
9. TCA – Tile Council of America, Handbook for Ceramic Tile Installation

1.4 SUBMITTALS

A. Refer to General Requirements and Division 01.

B. Submit shop drawings for approval before ordering tile. Include the following:

1. Plan, elevations, and sections of pool tank and deck.

C. Plans of all tile marking showing exact locations and positions of individual tiles.

D. Provide five copies of submittals.

1.5 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to General Requirements and Division 01.

B. Deliver all products to job in manufacturer's unopened containers with grade seals unbroken and labels intact.

C. Keep tile cartons dry.

1.7 WARRANTY

A. Contractor shall provide written materials and installation warranty to Architect/Engineer prior to filling pool with water.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish all ceramic tile required as follows. Colors shall be as selected by Owner and Architect.

B. Furnish all tiles required for special markings and lettering in conformance with the drawings and applicable Codes, including depth markings and no diving markers.

C. Racing lane tile edges shall be installed flush with finish pool floor.

D. Target tile shall be installed flush with finish pool wall.

E. Use surface bullnose on pool edge where required for proper trim and as directed on the drawings.

2.2 POOL CERAMIC TILE

A. Outdoor Pool Ceramic Tile

1. Dal-Tile - Keystone or equal.
   a. Sizes, types, and slip resistance as scheduled on the contract drawings.
   b. Slip resistance shall meet Dynamic Coefficient of Friction (DCOF) value of WET:> 0.42.
   c. Abrasive resistance shall meet DCOF value of WET:> 0.60 If required per contract drawings.
   d. Color as selected by Owner/Architect from Price Groups 3 & 4.
   e. Increase the slip resistance of all endwall target tile with the addition of 7.5% by weight abrasive grains.
   f. Frost proof.
2. Setting Materials
   a. Portland Cement: ASTM C150, Type I
   b. Hydrated lime: ASTM C206, 7 Type S
   c. Sand: ASTM C144
   d. Water: Clean and potable
   e. Dry-set mortar: Multi-cure as manufactured by the C-Cure chemical company, used with latex additive or Kerabond with Kerolastic additive or PCI-USA Non-Sag mortar and PCI Lastoflex waterproof membrane
3. Grout
   a. Commercial sanded Portland cement type with latex additive
   b. Flex grout by PCI-USA
4. Setting Methods
   a. Dry-Set Portland Cement Mortar (Thin-Set) on concrete using a minimum leveling bed.
      1) Follow ANSI A108.5 (Reference TCA).

2.3 EXTRA MATERIALS

A. Supply extra 5% of each color of flat and trim in clean marked cartons for Owner's use.

PART 3 - EXECUTION

3.1 ACCEPTABILITY OF SURFACES

A. Before tiling, check area to be tiled for acceptability as follows:

1. Surface medium-rough texture.
2. All surfaces to be tiled shall be free of dust, rust, paint, from oil or other release coatings.
3. Provision for ladders and other embedments at proper locations.
4. Concrete true to line, level, plumb and curvature.
5. Width, depth and length will permit finished accuracy of markings and dimensions.

3.2 ENVIRONMENTAL CONDITIONS

A. Protect all newly tiled areas.

B. Maintain temperature at 50 degrees F minimum during tile work and for seven days after completion or furnish protection as approved by the Architect/Engineer.

3.3 LAYOUT

A. Align all joints to give straight uniform grout lines.

B. Observe exact minimum length per dimensions shown on Contract Drawings.

C. Observe maximum width tolerance of 1" over dimensions shown in Contract Drawings.

D. Observe +/- 1/16" maximum finish elevation tolerance on all gutter edges.

E. Provide one expansion joint minimum at center of each straight run of tile.

3.4 WORKMANSHIP

A. Supply first-class workmanship in all tile work.

B. Use all products in strict accordance with recommendations and directions of manufacturer.

C. Proportion all mixes in accordance with latest ANSI Standard Specifications.

D. Smooth all exposed cut edges.

E. Gutter edges shall not vary from level or true plane more than 1/8" of pool static water level.

3.5 CLEANING

A. Clean tile surface as thoroughly as possible on completion of grouting.

B. Before acid cleaning, saturate with clean water all grout joints in areas to be cleaned.

C. Use one-part muriatic acid to nine parts water for cleaning off grout film.

D. As soon as cleaning is done, hose down thoroughly to completely remove all traces of residual acid.

END OF SECTION 13 1161

SECTION 13 1165 - WATER FLUME RIDE

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Scope of Work: Work shall include the furnishing of all labor, materials, equipment, engineering expertise and other incidentals to the construction of:

1. One (1) indoor-outdoor 32" aqua tube flume ride designed for use with dropout end.
2. Fiberglass flume components.
3. Flume support system.
4. Starting platform, all stairways and railings and steps as necessary to enter ride.
5. Concrete footings and foundations.

B. Work Provided Elsewhere in the Specifications or on the Drawings:

1. Furnish and install pumps for water supply to the slide and all necessary piping as specified by the successful water flume ride bidder.
2. Cut-outs in pool wall to accept slides.
3. Patch in and waterproofing of entry sections into the pool after installation of the slide.
4. Pool and deck structure around slide foundation and columns.
5. Refer to Division:
   a. Earthwork - 31.
   b. Concrete - 03.
   c. Pool - 13.
   d. Electrical - 26.
6. Refer to General & Supplementary Conditions - This contractor shall be bound by the General and Supplementary Conditions.

1.2 REGULATIONS

A. The Water Flume Ride starting platform, stairways and railings shall be designed and installed to conform to all requirements of:

1. The Department of Public Health, and all other state and local health and building codes.
2. WWA Considerations for Operating Safety, published by World Waterpark Association.
3. ASTM-F2376-08 "Standard Practice for Classification, Design, Manufacture, Construction, and Operation of Water Slide Systems".
4. Suggested Health and Safety Guidelines for recreational water slide flumes, published by U.S. Department of Health and Human Services.
5. Applicable local, provincial or state building codes.

1.3 SITE CONDITION

A. Topography - The drawings indicate the location and building information pertaining to the site for Water Flume.

B. Soils - Refer to Division 02.

1.4 USE OF SITE

A. General

1. The contractor will restrict his construction to the general area shown on the drawings.
2. Access and egress shall be coordinated with the general contractor and controlled so as not to conflict with the normal operations of the project.

B. Design

1. The design, shown on the drawings show the intended use and desired locations of the elements in relation to the adjacent deck uses.
2. The slide manufacturer, in providing its bid, warrants that it is licensed to do work in the project's state and municipality and holds appropriate professional registrations, permits and/or meets other requirements by authorities having jurisdiction.
3. The slide manufacturer shall indemnify and hold harmless the architect and the owner from any and all actions caused by or related to the design, fabrication and installation of the work of this specification section.

1.5 PERMITS & FEES

A. The manufacturer and/or the contractor shall provide sufficiently detailed information on all items furnished to secure all necessary permits, including but not limited to:

1. Building permit.
2. State Department of Public Health construction and operating permits.

B. All applicable fees and permits for construction will be paid for by the contractor(s) and shall be included in the bid price. The Department of Public Health construction permit for the swimming pools will be paid for by owner.

1.6 JOB CONDITIONS

A. Protection:

1. Use all means necessary to protect existing work and, in the event of damage, immediately make all repairs and replacements necessary, subject to approval of the architect/engineer and at no additional cost to the owner.

B. Store Products:

1. Contractor shall assume full responsibility for the protection and safe keeping of products under this contract stored on the site.

C. Lines, Levels and Layout of Work:

1. The contractor shall establish and guarantee all lines, levels, etc. called for on the drawings.
2. The contractor shall be responsible for the lines, levels, etc. of all his subcontractors.

1.7 SUBMITTALS

A. Submit in accordance with Division 0.

B. Construction Schedule:

1. The contractor will cooperate with scheduling determined for the complete job so as not to create any delays or slowdown of other contractors.

C. Shop Drawings:

1. Promptly after award of the contract, the contractor shall submit complete shop drawings to include, but not be limited to:
   a. Course layout with dimensions.
   b. Flume detail.
   c. Flume support details, including footings and foundations.
   d. Tower and stair details, including foundations, structural support, bracing, and starting chute as indicated on the plans.

e. Modifications to plunge area, if any, required for the safety of the contractor's slide path design.
f. Modifications to the slide pumps, if any, required for the contractor's slide path design.

2. All shop drawings shall be certified and sealed by a structural engineer, registered and licensed in the project state.

1.8 GUARANTEE/WARRANTY

A. Labor and Material Payments Bonds: The contractor may be required to furnish bonds equal to the total contract amount guaranteeing the payment of all labor and materials. See General Project Requirements.

B. Special Project Requirements: Manufacturer agrees to provide evidence of product liability insurance naming the owner, architect and Water Technology, Inc. as additional insured. This insurance will be maintained for a minimum of five (5) years or as required by statue, whichever is greater. In addition, the manufacturer agrees to indemnify, hold harmless, and defend the owner, the architect and Water Technology, Inc. including their agents and employees for any and all claims, damages, losses and expenses of whatsoever nature, including but not limited to claims for property damage, personal injury (including death), attorneys fees, litigation expenses, court costs and all other damages arising out of or incidental to, resulting from or in connection with performance of this manufacturer's work.

C. Qualification of Workmen: At least one (1) person who is thoroughly familiar with the materials, methods and equipment being utilized shall be present at all times during the construction to direct the work where required.

D. Approved Manufacturers - The following manufacturers have submitted sufficient information to be pre-qualified as sources of water flume equipment:

1. PROSLIDE TECHNOLOGY, INC., 2650 Queensview Dr. Suite 150, Ottawa, Ontario, CANADA K2B 8H6, (613) 526-5522.
2. SPLASHTACULAR Operations Facility Kansas: 102 W. Kaskaskia, Suite 201 Paola, KS 66071 (800) 844-5334; Corporate Office – California 78-670 Hwy 111, PMB 225 La Quinita, CA 99253.
3. WHITEWATER WEST INDUSTRIES, 730 W.Hampden Ave., Suite 303 Englewood, Co 80110 (800)775-4337

PART 2 - PRODUCTS

2.1 FIBERGLASS FLUME COMPONENTS

A. General: The fiberglass flume components are those various elements that compose the water flume and include:

1. Starting Section.
2. Curved Sections.
3. Straight Sections.
4. Drop or Accelerating Sections and Deceleration Sections.
5. Built-up Sections Including Lead-ins and Lead-outs.
6. Exit Section or End Section.
7. All other incidental fiberglass components necessary for a complete system.
8. All sections shall be bolted and caulked. No fiberglass joints allowed.

B. Fiberglass Laminate Materials:

1. Gelcoat: Interior gel coat shall be "crystal clear" high quality isophtalic polyester with U.V. inhibitors. 20 mils thickness. Exterior coat 18 mils wet clear gloss U.V. protective coating.
2. Resins: Thixotopic promoted low profile polyester resin with alternate layers of continuous roving chop and 18 oz. woven roving.

3. Structure: Fiberglass lamination with sandwich panel center line reinforcement. Standard flume section shall be 3/16" thick, minimum weight 14 oz. per square foot. Flanges shall be minimum 1/4" thick and extend at least 4-3/4" from the slide surface, "L" type.

C. Joints, Connections and Seams:

1. Flume to flume joints shall be fastened with 3/8" stainless steel bolts, washers (2 per bolt), and self-locking nuts.
2. Flume to support system connections shall be made with stainless steel hardware and shall be connected separately form water slide section connections.
3. Fiberglass joint connections shall be made using waterproof non-shrink caulking with suitable adhesion to fiberglass. Silicone sealants will not be permitted.
4. Fiberglassing over seams within the riding surface is not permitted. Sanding within the slide surface should be minimized to maintain adequate gel coat thickness and gloss. Any sanded areas shall be polished to a high gloss until undetectable.

D. Color:

1. Shall be as standard to the manufacturer, and approved by architect/engineer, integral to the fiberglass and the same top and bottom (inside and outside). Verify color selection with architect and owner.

E. Ride Configuration:

1. The body slide length and configuration shall be as indicated in the drawings.
2. Alternate configurations will be considered if rides commence and terminate at the same location/elevation, are of the same length and configuration, and all other features of the specifications are met.

F. Required Components: All slides shall be furnished with the following components:

1. Entry tray shall be pre-plumbed for water injection down-stream of the rider entry point. Rider entry area shall be a non-skid surface, no steps are permitted.
2. Factory pre-drilling of all sections.
3. Waterproof joint sealant as specified in Article 2.01.C.
4. Stainless steel assembly hardware as specified in Article 2.01.C

2.2 FLUME SUPPORT, TOWER AND STAIR SYSTEM

A. General: The flume support tower and stair system shall consist of all elements necessary to safely and securely support the fiberglass water flume from the starting platform to the plunge pool and consists of:

1. Concrete footings and foundations, including excavation, backfill and compaction.
2. Concrete supports.
3. Factory painted galvanized steel tower and stair system. Follow paint manufacturer's specifications for surface preparation of galvanized steel.
4. All connecting hardware.

B. Design: The supports and footings shall be certified by a licensed structural engineer in the project state for the soil conditions as indicated, and the stresses generated by the water flume ride during use.

C. Concrete

1. Cast-in-place: Minimum compressive strength shall be 3,000 psi at 28 days. Maximum size aggregate shall be 3/4 inch. Slump shall not be more than 3 inches. Concrete shall be

vibrated but not to excess so as to cause segregation of materials. Check all applicable drawings for locations of blockouts, anchors, inserts, etc. before concrete is placed.

2. Reinforcing Steel:
    1. Fy = 60,000 psi min., for: ASTM A615 (deformed bar) or equivalent. ASTM A82 (welded wire fabric) or equivalent.
3. Unless otherwise noted, concrete cover of reinforcing shall be as follows: Footing 3 inches and walls, pedestals, and columns 1 ½ inch minimums.
4. All concrete procedures to conform to latest ACI Building Code.
5. Steel reinforcing lap splices for concrete slab shall be a minimum of 36 bar diameter.

D. Structural Steel

1. Shall consist of radial arms with end yoke type fastening assembly for each support point. (NOTE: A central column support with radial arms may be used to support circular sections of 180 degrees or greater.)
2. Structural steel shall be new material of sizes and shapes listed in current AISC handbooks and as indicated on drawings.
3. Shapes and plates: ASTM A36 or equivalent minimum Fy = 36,000 psi (248.2 MpA).
4. Square structural section: ASTM A500 minimum Fy = 46,000 psi (317 MpA).
5. Round steel pipes: ASTM A53 grade B minimum Fy = 35,000 psi (241.3 MpA).
6. Cast steel: ASTM A27 minimum Fy = 36,000 psi or equivalent.
7. Tension rods, bolts, and anchor bolts: ASTM A36 minimum allowable tensile stress Ft =19,100 psi (131.7 MpA).
8. Structural bolts: ASTM A325, friction type or equivalent minimum allowable shear stress, Fv = 21,000 psi (144.8 MpA). Minimum allowable tensile stress, Ft = 44,000 psi (303.4 MpA).
9. Welding electrodes: E480XX electrode (E70XX). Minimum allowable shear stress, Fv=21,000 psi (144.8 MpA).
10. Grout: Masterflow 713 or approved equal non-shirk, non-metallic grout. Use as recommended by manufacturer.
11. All plates, shapes and tubes in contact are to be welded with ¼-inch minimum fillet welds all around unless otherwise indicated.
12. Unless otherwise noted all steel structure shall be galvanized.
13. Contractor shall supply temporary bracing to take care of all loads on the structure during erection to ensure the safety of the structure, leave as long as is required, remove when safety is assured.
14. All flumes and support arms shall be properly set and installed prior to installation of permanent column bracing. Additional column bracing as required by engineer, in addition to those noted on the drawing, shall be provided upon site inspection.
15. All hollow structural sections shall be closed airtight with end plates sealed with welds.
16. All steel shall be thoroughly cleaned of all loose mill scale, loose rust, oil and dirt.
17. Surface to be welded shall be free from loose scale, rust, paint or other foreign matter. Care shall be taken to minimize stresses due to heat expansion, contraction and distortion by using proper sequence in welding and by other approved methods.
18. Fabrication and erection shall conform to the latest editions of the ASTM Specifications and Code of Practice: Welding shall be done by welders certified with AWS D-1.1.
19. Equivalent structural steel sizes listed in current AISC or CISC Handbook may be used upon approval of the architect/engineer.
20. Definitions:
    a. ASTM - American Society of Testing Materials.
    b. AISC - American Institute of Steel Construction
    c. CISC - Canadian Institute of Steel Construction

E. Column System

1. A single or multiple concrete post system shall be used.

F. Starting Tower/Stairway/Railing

1. General -The starting tower/stairway shall consist of:
   a. A factory painted galvanized tower and stair support system with Duradek T-1800 or fiberglass grating. Risers shall be closed.
   b. All stair treads shall have a step edge of a contrasting color.
   c. Powder Coated Type 304 Stainless Steel. Color Selection by Owner/Architect.
   d. Bracing and structural support (non-corrosive).
   e. Hand rails on both sides of entire stair tower.
2. Design
   a. The structured design shall be certified by an engineer licensed in the project state. Structure shall be sized to handle the user volumes, the height required by the flume length, and the location on the existing topography.
   b. Stair design shall follow current State building codes.
   c. Coordinate with slide manufacturer.
3. Concrete Footings & Piers
   a. Shall be designed and constructed to support the design loads.
   b. All concrete shall have a minimum twenty-eight (28) day compressive strength of 4,000 psi.
   c. All footings shall be on undisturbed soil.
   d. Vertical members shall be on concrete footings, above grade and be secured with flange plates and anchor bolts.
4. Hardware
   a. Steel Hardware, ASTM A-7 or A-36 (hot dipped galvanized).
   b. Bolts, Federal Specification FF-B-SC1.
5. Starting Tower
   a. Shall be factory painted hot dipped galvanized steel structure and shall be supported by their own hot dipped galvanized steel columns. Coordinate design with building structural engineer and slide manufacturer.
   b. Shall have Duradek T-1800 or Fibredek fiberglass grate, decking, treads, and closed risers.
6. Stairs and Railings
   a. Stairs shall have factory painted hot dipped galvanized steel stringers with fiberglass grating treads and closed panels. Stairs shall have four foot minimum width.
   b. Rail system shall be a minimum of 42" high at any point, non-climbable and designed to prevent accidental exit. Handrails shall be located at 34" above stair riser. Color selection by architect and owner.
   c. The stair entry shall be provided with a 42" high lockable gate of similar construction as the rail system.
7. Finish
   a. All galvanized metal:
      1) Wash all galvanized to be painted with a simple green soap, rinse thoroughly.
      2) Clean galvanized surfaces with Xylene, which will leave a whitish film - do not remove film.
      3) Prime galvanized with Devoe Tru-Glaze Epoxy Primer # 12735/12702, following manufacturer's instructions.
      4) Finish coat to be Devoe Deythane 369 Aliphatic Urethane Gloss Enamel #369-K-XXXX, following manufacturer's instructions - color by owner.
      5) Second coat may be necessary, depending on appearance of first finish coat; second coat to be Devoe Deythane 369 Aliphatic Urethane Gloss Enamel #369-K-XXXX.
   b. All ferrous metal parts:
8. Surface Preparation: Blast all surfaces to be coated to the extent of an SSPC-SP6 commercial-grade level of cleanliness. Create a 1.5 - 2.0 mil profile and prime before any rust bloom forms on the surface.
9. Primer: Spray apply, in the shop, one full coat of Tnemec Series 90-97 Aromatic Urethane Zinc-Rich or Amercoat 68 HS primer to a DFT of 4.0 mils. Allow to cure as per data sheet (4 hours @ 75°F) before applying topcoat.
10. Topcoat: Spray apply in the shop one even finish coat of Tnemec Series 74-Color Endura-Shield. Acrylic Polyurethane or Ameron PSX-700 finish to a minimum DFT of 5.0 mils. Allow to cure as per data sheet (6 hours @ 75°F) before handling/loading in the shop.

11. Field Touchup: If the broken area of the shop applied film is rough from scaring, disc-abrade that area smooth and then solvent clean it as per an SSPC-SP1, level of cleanliness. Brush or roller apply one coat of Tnemec Series 135 Chembuild or Ameron epoxy primer. Allow to cure as per data sheet. Brush or roller apply one coat of Tnemec Series 74 or Ameron PSX-700 shop applied color to bring the film up to specification thickness.
    a. Fiberglass handrail posts:
        1) Finish: Tnemec Series 74 or Ameron PSX-700 shop applied at 5.0 mils DFT.
        2) Field Touch-up: Tnemec Series 74 or Ameron PSX-700 shop applied at 5.0 mils DFT.
        3) Manufacturer: Tnemec 816/483-3400 or Amercoat 800/244-0025 or pre-approved equal.
    b. Top deck and landing shall have a non-slip finish.
    c. Treads non-slip shall have a non-slip finish.
    d. All exposed concrete vertical surface shall have a sack rubbed finish.
    e. Seal all concrete with a minimum of two (2) coats of slip resistant Concrete Sealer.
    f. Colors shall be as selected by the architect and owner.

PART 3 - EXECUTION

3.1 GENERAL

3.2 The installation of this work shall comply with the following governing and regulatory authorities.

A. Department of Labor (OSHA).

B. State Department of Public Health.

C. All State and Local Building Codes.

D. Any other agency that has legal jurisdiction.

3.3 FLUME CONSTRUCTION

A. All construction shall conform to the recommendations of the approved manufacturer selected through this bidding process.

B. The manufacturer shall be responsible for the quality of the flume material and equipment.

C. The slide manufacturer shall be responsible for the layout, assembly and erection of the flume products in a workmanlike manner.

D. Flume joints shall be properly connected so as to avoid abrupt edges that may cause irritation.

E. Flume flanges shall be bolted together with 3/8-inch diameter bolts. All connectors shall be stainless steel.

F. Polyurethane sealant or any other approved sealant shall be provided on each flange connection.

G. All flumes shall be properly cleaned and surfaces smooth finished, and complete with all the necessary sections prior to use of the slide.

H. All flumes underground shall be carefully backfilled to prevent the flumes from getting damaged. All fill in contact with flume shall be of good quality and free of boulders.

I. Flumes shall be inspected by the representative of the slide manufacturer to ensure a smooth finish prior to acceptance of work.

3.4 OWNER INSTRUCTION

A. In addition to Section 131500 requirements for operation/maintenance instructions, the slide manufacturer shall deliver four complete sets of operating and maintenance instructions bound together in a complete manual for the slide(s) to the Architect/Engineer. Including, but not limited to the following:

1. Narrative on the slide operation including recommended loading procedures and operation through all sequences.
2. Recommended user requirements including recommended signage and height and weight restrictions.
3. Written slide warranty and contact information.
4. Maintenance information and recommended maintenance program.

END OF SECTION 13 1165

SECTION 22 0517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

C. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Zurn
2. Josam.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
1. Underdeck Clamp: Clamping ring with setscrews.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2-inches above finished floor level.
3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions. Cut sleeves to length for mounting flush with both surfaces.
1. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 9200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.2 SLEEVE SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Concrete Slabs-on-Grade:
a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
2. Interior Partitions:
a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves PVC-pipe sleeves.
b. Piping NPS 6 Insert pipe size and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 22 0517

SECTION 22 0518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
1. Escutcheons for New Piping:
a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 0518

SECTION 22 0523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Brass ball valves.
2. Bronze ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.
1. Certification that products comply with NSF 61 Annex G.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.18 for solder-joint connections.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:
1. Gear Actuator: For quarter-turn valves NSP 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:
1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. One-Piece, Brass Ball Valves:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Forged brass or bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Brass or stainless steel.
h. Ball: Chrome-plated brass or stainless steel.
i. Port: Reduced.

2.3 BRONZE BALL VALVES

A. One-Piece, Bronze Ball Valves with Bronze Trim:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 22 0553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

C. Valves are to be full flow valves with the same interior dimension as the piping they are attached to.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe 3" and Smaller:
1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. One piece, brass ball valve.
3. One piece, bronze ball valve with bronze trim.

END OF SECTION 22 0523

SECTION 22 0523.14 - CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Bronze lift check valves.
2. Bronze swing check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.
1. Certification that products comply with NSF 61 Annex G.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.18 for solder joint.
3. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:
1. Description:
   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig.
   c. Body Design: Vertical flow.
   d. Body Material: ASTM B 61 or ASTM B 62, bronze.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:
1. Description:
   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200 psig.
   c. Body Design: Vertical flow.
   d. Body Material: ASTM B 61 or ASTM B 62, bronze.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: NBR, PTFE.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze, Swing Check Valves with Bronze Disc:
1. Description:
   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
1. Description:
   a. Standard: MSS SP-80, Type 4.
   b. CWP Rating: 200 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: PTFE.

C. Class 150, Bronze Swing Check Valves with Bronze Disc:
1. Description:
   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 300 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.

e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:
1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements in Section 22 0553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. End Connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. All pipe sizes: Bronze swing check valves, Class 125, bronze disc with soldered or threaded end connections.

END OF SECTION 22 0523.14

SECTION 22 0523.15 - GATE VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Bronze gate valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. NRS: Nonrising stem.

C. OS&Y: Outside screw and yoke.

D. RS: Rising stem.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.
1. Certification that products comply with NSF 61 Annex G.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate valves closed to prevent rattling.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.

5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. RS Valves in Insulated Piping: With 2-inch stem extensions.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE GATE VALVES

A. Bronze Gate Valves, NRS, Class 125:
1. Description:
a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: Bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

B. Bronze Gate Valves, NRS, Class 150:
1. Description:
a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig.
c. Body Material: Bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 22 0553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. Use gate valves for shutoff service only.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. For Grooved-End Copper Tubing: Valve ends may be grooved.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze gate valves, NRS, Class 125 with threaded ends.

B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS, Class 125 with flanged ends.

END OF SECTION 22 0523

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fastener systems.

B. Related Sections:
1. Section 05 5000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. 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: 34.5-MPa, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal 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 the building structure.

B. Metal 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 for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4-inch thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2 ½" 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.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

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 allowed by 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 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 4" and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following: NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 thick. NPS 4: 12 inches long and 0.06 inch thick. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick. NPS 8 to NPS 14: 24 inches 610 long and 0.075 inch thick. NPS 16 to NPS 14: 24 inches long and 0.105 inch thick.
5. Pipes 8" and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; 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 so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09 9123 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in 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 carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use stainless-steel pipe hangers and attachments for hostile environment applications.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes MPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8..
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment for heavy loads.
2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 0529

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A.

Metal Labels for Equipment:
1. Material and Thickness: Brass, 0.32" minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: Yellow.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½" x ¾".
5. Minimum Letter Size: ¼" for name of units if viewing distance is less than 25", ½" for viewing distances up to 72", and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: Yellow.
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 ½" x ¾".
6. Minimum Letter Size: 0.25" for name of units if viewing distance is less than 25", ½" for viewing distances up to 72", and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on A4 bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 0.625" thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

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 ½" x ¾".

F. Minimum Letter Size: ¼" for name of units if viewing distance is less than 25", ½" viewing distances up to 72", and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters 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.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.4 STENCILS

A. Stencils for Piping:
1. Lettering Size.
2. Stencil Material: Aluminum.
3. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
4. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1.4" letters for piping system abbreviation and 1.4" numbers.
1. Tag Material: Brass, 0.03125" minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain.

B. Valve Schedules: For each piping system, on A4 bond paper. 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.
1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
1. Size: 3" by 5 ¼" minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 09 9123 "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels,at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings
in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations 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' along each run. Reduce intervals to 25' in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:
1. Domestic Water Piping
   a. Background: Safety green.
   b. Letter Colors: White.
2. Sanitary Waste Piping:
   a. Background Color: Safety black.
   b. Letter Color: Black.

3.5 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 similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
   a. Cold Water: 1.5", square.
   b. Hot Water: 1.5", square.
2. Valve-Tag Colors:
   a. Cold Water: Safety green.
   b. Hot Water: Safety green.
3. Letter Colors:

a. Cold Water: White.
b. Hot Water: White.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:
1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Sanitary waste piping exposed to freezing conditions.
5. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
1. Preformed Pipe Insulation Materials: 12" long by NPS 2.
2. Jacket Materials for Pipe: 12" long by NPS 2.
3. Sheet Jacket Materials: 12" square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. 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.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.
1. Piping Mockups:
   a. One 10-foot section of NPS 2 straight pipe.
   b. One each of a 90-degree threaded, welded, and flanged elbow.
   c. One each of a threaded, welded, and flanged tee fitting.
   d. One NPS 2 or smaller valve, and one NPS 2 ½ or larger valve.
   e. Four support hangers including hanger shield and insert.
   f. One threaded strainer and one flanged strainer with removable portion of insulation.
   g. One threaded reducer and one welded reducer.
   h. One pressure temperature tap.
   i. One mechanical coupling.
2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

D. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Fiberglass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
4. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Fiberglass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-ml dry film thickness.
2. Service Temperature Range: Minus 20 deg F to plus 180 deg F.

3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.2 metric perms at 0.86" dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants for Fiberglass and Phenolic Products:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3".
   2. Thickness: 11.5 mils.
   3. Elongation: 2 percent.
   4. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Width: 3".
   2. Thickness: 6.5 mils.
   3. Elongation: 2 percent.
   4. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Width: 2"
   2. Thickness: 6 mils.
   3. Elongation: 500 percent.

2.9 SECUREMENTS

A. Bands:
   1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
   2. Aluminum: ASTM B 209M, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:
   1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:
   1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3"-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4" o.c.
3. Overlap jacket longitudinal seams at least 1 ½". Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2" o.c.
   a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4" beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FIBERGLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
1. ¾" and Smaller: Insulation shall be the following:
   a. Fiberglass: ½" thick.
2. 1" and Larger: Insulation shall be the following:
   a. Fiberglass: 1" thick.

B. Domestic Hot and Recirculated Hot Water:
1. ¾" and Smaller: Insulation shall be one of the following:
   a. Fiberglass: 1" thick.
2. 1" and Larger: Insulation shall be one of the following:
   a. Fiberglass: 1-1/4" thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1" thick.

END OF SECTION 22 0719

SECTION 22 1113 – FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water distribution piping and related components outside the building which are to be retained by the Owner as private improvements at the completion of the project.

1.2 RELATED DOCUMENTS

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

1.3 REFERENCED STANDARDS

A. Latest version or edition shall apply unless otherwise noted.
   1. American National Standards Institute (ANSI)
      a. A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
      b. A21.16, Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.
   2. American Society of Mechanical Engineers (ASME)
      a. B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
      b. B16.24, Cast Copper Pipe Flanges and Flanged Fittings.
   3. American Society of Testing and Materials (ASTM) International
      a. A48, Standard Specification for Gray Iron Castings.
      b. A126, Standard Specification for Gray Iron Casting for Valves, Flanges and Pipe Fittings.
      c. A252, Standard Specification for Welded and Seamless Steel Pipe Piles.
      d. A276, Standard Specification for Stainless Steel Bars and Shapes.
      e. C536, Standard Specification for Ductile Iron Castings.
      f. A564, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
      g. A743, Standard Specification for Casting, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant for General Application
      h. F645, Standard Guide for Selection, Design and Installation of Thermoplastic Water-Pressure Piping Systems.
      i. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
      j. D2241, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
      k. D2774, Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
      l. D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
      m. D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
      n. D3740, Standard Practice for Minimum Requirements for Agencies Engaged in Testing in/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
      o. E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing or Special Inspection.
      p. F477, Standard Specification for Construction Procedures for Buried Plastic Pipe.
      q. F1668, Standard Guide for Construction Procedures for Buried Plastic Pipe.
   4. American Water Works Association (AWWA)
      a. C116, Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.
      b. C153, American National Standard for Ductile-Iron Compact Fittings for Water Service.

c. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.
d. C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings or Water.
e. C651, Disinfecting Water Mains.
f. C800, Underground Service Line Valves and Fittings.
g. C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm) for Water Transmission and Distribution.
h. M23, PVC Pipe-Design and Installation.
i. M44, Distribution Valves Selection, Installation, Field Testing and Maintenance.

5. Federal Specification
   a. TT-V-51F, Varnish: Asphalt.
6. Factory Mutual Global (FMG)
   a. Approval Guide.
7. National Fire Protection Association (NFPA)
   a. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
8. National Science Foundation (NSF)
   a. Standard 14, Plastics Piping System Components and Related Materials.
   b. Standard 61, Drinking Water System Components.
9. Society of Automobile Engineer (SAE)
   a. 30303, Steel, Corrosion Resistant, Bars, Wire and Forgings.
10. Underwrite Laboratories (UL)
    a. Fire Protection Equipment Directory.

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.

B. AHJ: Authority Having Jurisdiction.
   1. City of Tulsa and State Fire Marshall's Office
      a. Fire hydrant type and location.
      b. Fire Department Connection (FDC) type and location.
   2. City of Tulsa, Utilities Department
      a. Municipal permitting and work order requirements.
      b. Tapping of water mains and backflow prevention.
      c. Inspections of constructed private water distribution improvements as required to ensure compliance with adopted plumbing code.
      d. Type of domestic and irrigation meter(s).
      e. Type and location of proposed meter enclosure(s).
   3. Oklahoma Department of Environmental Quality
      a. State permitting and regulatory requirements.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Final Backfill: Backfill placed over initial backfill to fill a trench.

E. Geotechnical Testing Agency: to be appointed by Owner. Geotechnical Testing Agency shall be qualified per requirements of ASTM E329 and ASTM D3740 for testing as indicated. Documentation of said qualifications shall be submitted to Engineer for review and approval prior to performance of work.

F. IPC: International Plumbing Code, version to be as adopted by City of Oklahoma City Plumbing Inspector's Office.

G. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

H. PE: Polyethylene plastic.

I. PVC: Polyvinyl chloride plastic.

J. Utility Owner: Owner of existing water distribution system.
   1. City of Tulsa.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product used in completion of the scope of work.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:

   1. All materials and methods shall comply with the requirements of the AHJ. Requirements shall be considered to include:
      a. Tapping of water mains and backflow prevention.
      b. Materials, installation, testing and disinfection associated with:
         1) Domestic water service piping.
         2) Fire suppression water service piping.
         3) Combined domestic and fire suppression water service piping.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F645 for selection, design, and installation of thermoplastic water piping.

D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

F. NSF Compliance:

   1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
   2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.7 DELIVERY, STORAGE AND HANDLING

A. Preparation for Transport: Prepare valves and fittings according to manufacturer's recommendations. At a minimum Contractor shall be responsible for the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves close to prevent rattling.

B. During Storage: Use precautions for valves and fittings according to the following:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fittings if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage and handling to prevent pipe-end damage and to prevent entrance of dirt, debris and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight as required by pipe manufacturer. Support to prevent sagging and bending.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions:

1. Written authorization from the Utility Owner.
2. Written authorization from the Owner.

1.9 COORDINATION

A. Coordinate connection to or tapping of existing water mains with Utility Owner.

B. Acquisition of any necessary permits or work orders from the AHJs shall be the responsibility of the Contractor. Said permits shall be acquired prior to procurement of materials or initiation of construction activities.

PART 2 - PRODUCTS

2.1 PRIVATE PVC WATER LINES

A. Medium Diameter Lines (NPS 1.5 to NPS 3):
1. Pipe: PVC Pressure Pipe per ASTM D2241, SDR 21, Class 200.
2. Joints: Integral bell joint per ASTM D3139, flexible gasket per ASTM F477.
3. Fittings:
   a. NPS: Ductile iron compact fittings per AWWA C153. Joint type shall be as indicated on drawings.
   b. NPS 1.5 to NPS 2.5:
      1) Materials: ASTM D1784, NSF Approved for Potable Water, NSF 61.
      2) Joints: ASTM D3139.
      3) Gaskets: ASTM F477.
      4) Wall Thickness: SDR 21.
      5) Pressure Rating: 200-psi.

B. Large Diameter Lines (NPS 4 to NPS 12):
1. Pipe: AWWA C900, SDR 14 (Pressure Class 305, FM Approval Pressure Class 200) with gasketed bell and spigot ends per ASTM D3139.
2. Joints: Integral bell joint per ASTM D3139, flexible gasket per ASTM F477.
3. Fittings: Ductile iron compact fittings per AWWA C153. Joint type shall be as indicated on drawings.

2.2 PE PIPE AND FITTINGS

A. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than 160 psig.

1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 160 psig.

2.3 PEX PIPE AND FITTINGS

A. PEX Pipe: ASTM F876, ASTM F877 CSA B137.5, NSF/ANSI 14 and NSF/ANSI 61; and approved by the manufacturer's PEX piping system, with applicable plumbing code certifications. Required to give pressure rating not less than 160 psig.

1. Fittings: PEX Crimp fittings for use with copper crimp rings shall be manufactured meeting the requirements of ASTM F1807 and/or ASTM F2159. The PEX Crimp connection shall be made by use of full circle crimp tool designed to crimp F1807 copper crimp rings.

2.4 WATER METERS

A. Water meters to be installed during the project will be owned and maintained by the AHJ for the purposes of metering water consumption on the property.

B. Contractor responsible for construction/installation of meter enclosure(s) documented in the Construction Drawings and/or specified by the AHJ. Contractor shall also be responsible for

any associated modifications to the meter enclosure(s) requested by the AHJ and their inspectors.

C. All impact fees and meter costs shall be the responsibility of the Contractor.

D. Irrigation: Water meters dedicated to providing service to proposed irrigation system(s) shall be protected by a backflow prevention device which meets or exceeds IPC requirements. Contractor responsible for coordinating location of and connection to backflow prevention device.

2.5 TRANSITION COUPLING AND SPECIAL FITTINGS

A. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating shall be used when making connection between dissimilar piping materials. Said couplings shall meet or exceed all IPC requirements (version as adopted by the AHJ).

2.6 WATER METER BOXES

A. Description: 20 gauge, galv., corrugated steel, complete with cast iron locking lid. Lid to be marked "Water" in raised letters. 5/8 x ¾ boxes to be 18" diameter x 18" high & 1" boxes to be 24" diameter x 24" x 24" high. As manufactured by Western Foundry, Bass and Hayes, or Tyler Pipe and Foundry or approved equal.

2.6 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. Mueller H-2380-20
   b. Mueller A2370-20
   c. M&M Fig. 67M
   d. M&M Fig. 3067
   e. American Darling No. 55
   f. American Darling CRS-80
   g. Clow F-6100
   h. Clow AVK 25/30
   i. Clow AVK 18/07
   j. or approval equal

2. Nonrising-Stem, Resilient-Seated Gate Valves:

   a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 200 psig.
      3) End Connections: Mechanical joint comply with AWWA C1111.
      4) Interior Coating: Complying with AWWA C550.
      5) Dry Had, left hand opening
      6) Stem Seal: O-Ring

2.8 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
   b. East Jordan Iron Works, Inc.
   c. Flowserve.
   d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
   e. McWane, Inc.; Kennedy Valve Div.
   f. McWane, Inc.; M & H Valve Company Div.
   g. Mueller Co.; Water Products Div.

h. U.S. Pipe and Foundry Company.
i. or approved equal

2. Description: Sleeve and valve compatible with drilling machine.
   a. Standard: MSS SP-60.
   b. Tapping Sleeve: Stainless-steel (unless ductile iron is required by AHJ), two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
   c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
   1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
   2. 5 – ¼" shaft. 2 piece.
   3. Product: Tyler series 6855 or approved equal.
   4. Type: Adjustable of the slip type

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.9 PLUG VALVES

A. Plug Valves:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
      a. DeZURIK/Copes-Vulcan; a unit of SPX Corporation.
      b. Homestead Valve; a division of Olson Technologies, Inc.
      c. Milliken Valve Company.
      d. McWane, Inc.; M & H Valve Company Div.
      e. Pratt, Henry Company.
      f. Val-Matic Valve & Manufacturing Corp.
      g. or Approved equal
   2. Description: Resilient-seated eccentric.
      a. Standard: MSS SP-108.
      b. Body: Cast iron.
      c. Pressure Rating: 175-psig minimum CWP.
      d. Seat Material: Suitable for potable-water service.

2.10 CORPORATION VALVES

A. Manufacturers:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Mueller H-15000
      b. Ford F600
      c. McConald 4701 B
      d. or Approved equal
   2. Inlet shall be AWWA thread, outlet shall be coupling for copper pipe, flared coupling.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

PART 3 - EXECUTION

3.1 EARTHWORK

A. For Private PVC Installations, completed trenching/excavation, bedding and backfill per the requirements of ASTM D2774:
   1. Trenching/Excavation:
      a. Trench Stability: During trench excavation, ensure that the trench sides shall be stable under all working conditions. The trench walls shall be sloped or appropriate supports provided to comply with all applicable local, state and federal requirements for safety.
      b. Trench Width: The width of the trench at any point below the top of the pipe shall be sufficient to provide adequate room for each of the following requirements:
         1) Joining the pipe in the trench if this is required.
         2) Snaking of small diameter, heat fused or solvent cemented pipe form side-to-side along the bottom of the trench, when the effects of contraction are not otherwise accommodated.
         3) Filling and compacting the side fills.
         4) Checking the elastomeric seal joints.
         5) Minimum trench widths shall be permitted to be utilized with most solvent-cemented pressure pipe materials by joining the pipe outside the trench and lowering the pipe into the trench after adequate joint strength has been attained. This practice shall be permitted to be used for gasket joint pipe, with manufacturers approval, providing care is taken to not disassemble the joints during lowering.
      c. Trench Bottom: The trench bottom shall be prepared for the direct replacement of the pipe and shall be continuous, relatively smooth, free of rocks and provide uniform support. For bell-ended or coupled pipe, suitable "bell-holes" shall be provided at each joint to permit the joint to be assembled and the pipe to be supported properly.
         1) Where ledge rock, hardpan or boulders are encountered, it shall be required to pad the trench bottom with a bedding of at least 4-in thickness of compacted Class I or II material per ASTM D2774. In situations where rapid movement of water takes place through this bedding, the Class I or II material used shall have gradation that prevents loss of migration of any pipe embedment material.
      d. Trench Depth and Pipe Cover: Excavation for pipe trenches shall be to the lines, grades and dimensions shown on the contract drawings. Sufficient cover shall be maintained to adequately reduce the traffic or other concentrated and impact loads.
         1) Reliability and safety of service shall assume major importance in determining minimum cover for any intended service. Local, state or federal codes shall also govern. Pipe intended for winter water service shall have minimum cover equal to or greater than the maximum expected frost penetration depth.
         2) A minimum cover of 48-in for pipe shall be required when subjected to heavy overhead traffic. In areas of light overhead traffic a minimum cover of 36-in is required.
   2. Bedding and Backfill:

a. The pipe shall be uniformly and continuously supported over its entire length on firm stable material. Blocking shall not be used to change pipe grade or to intermittently support pipe across excavated sections.
b. Pipe shall be permitted to be installed in a wide range of native soils. The pipe embedment shall be stable and placed in such a manner as to evenly support and physically shield the pipe from damage. Attention shall be given to local pipe laying experience which shall indicate solutions to particular pipe bedding problems.
c. The pipe embedment materials shall be stable, sufficiently workable to be readily placed under the sides of the pipe to provide satisfactory haunching, and readily compactable to achieve soil densities specified by contract documents. The embedment shall be either Class I, II or III soils, as described in ASTM D2774.
d. Initial backfill materials shall be placed in compacted layers.
e. All native and other materials in the pipe embedment zone shall be free from refuse, organic material, cobbles, boulders, large rocks or stones or frozen soils.
f. The particle size of material in contact with the pipe shall not exceed the following: ½-in for pipe to NPS 4, ¾-in for pipes NPS 6 to NPS 8, 1-in for pipes NPS 10 to NPS 16 and 1 ½-in for pipes larger than NPS 16. Each soil layer shall be sufficiently compacted to uniformly develop lateral passive soil forces during the backfill operation.
g. To minimize deformation of thinner-walled pressure pipelines, such as used in irrigation, the pipeline shall be first filled with water, all air removed and kept full during the backfill operation.
h. When installing pipe in locations where rapid movement of ground water shall result in migration of soil fines into, out of, or between layers of the embedment material, the bedding and backfill shall be of such gradation in particle size as to preclude this possibility. Soil migration shall also be controlled by using an appropriate soil filter or a geotextile filter fabric between coarse embedment and fine soils.
i. Placement and compaction of recommended soils shall be per Section 14 of ASTM F1668.
j. Uncompacted final backfill can be either Class I, II, III, IV or V soil per ASTM D2774. If backfill is to be compacted, do not use Class V soils. The final backfill shall be placed and spread in approximately uniform layers in such as manner as to fill the trench completely so that there will be no unfilled spaces under or about rocks or lumps of earth in the backfill. Large rocks, stones, frozen clods and other debris greater than 3 in. in diameter shall be removed. When compaction is required, rolling equipment or heavy tampers shall only be used to compact the final backfill, provided the pipe covered by at least 18 in. of backfill. Trenches under pavements, sidewalks or roads shall be backfilled and compacted to the required density specified by contract documents or by the appropriate government jurisdiction.

3. Geotechnical Testing Agency shall test compaction of soils in place according to ASTM D2922 or other methods approved by the Geotechnical Engineer. Tests shall be performed at each compacted initial and final backfill layer. One test shall be completed for every 100 feet or less of trench length, but no fewer than two tests.
   a. When testing agency reports that subgrades, fills or backfill have not achieved degree of compaction specified, scarify and moisten or aerate or remove and replace soil material to depth required; recompact and retest until specified compaction is obtained.

3.2 PIPING INSTALLATION

A. Connection to existing water main: Arrange with Utility Owner for water main tap. Size and location to be as indicated on Construction Drawings. Contractor to confirm and coordinate location with AHJ prior to initiation.
   1. All tapping material and procedures shall be per the requirements of the AHJ.

B. Private PVC Installations: Install pipe in accordance with ASTM S2774 and AWWA C605.

C. Private Fire Service Mains and their Appurtenances: Private installations which will provide fire protection for the facility at the completion of the project shall also comply with NFPA 24.

D. Bury piping with depth of cover indicated on Construction Drawings.
   1. Beneath Paved Areas: Contractor shall set top of pipe as required to ensure pipe will be protected during sub-grade preparation. A minimum vertical separation of 24-in shall be maintained between the bottom of the proposed sub-grade section and the top of the proposed water line. Contractor shall coordinate work as required.
   2. Field Adjustments: Adjustments in vertical alignment of pipe are subject to the review and approval of the Engineer. In no case shall distance from finished grade to top of proposed pipe be less than 36-in.

E. Install piping by boring under streets and other obstructions that cannot be disturbed.

F. Extend private water lines from water meter installation and connect to building water piping systems, including domestic and fire suppression systems, at outside face of building wall in locations and pipe sizes indicated on Construction Drawings.
   1. Terminate private water lines at building wall until building water systems are installed. Terminate piping with caps, plugs or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
   2. Contractor responsible for coordinating site water distribution improvements with building systems. Location and elevation of connection point at building face shall be confirmed prior to initiating construction site water distribution improvements.

G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-point piping, thrust blocks, anchors, tie-rods and clamps and other supports as required.

H. Do not use flanges or unions for underground piping.

I. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

3.3 ANCHORAGE INSTALLATION

A. General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
   1. Concrete thrust blocks.
   2. Locking mechanical joints.
   3. Set-screw mechanical retainer glands.
   4. Bolted flanged joints.
   5. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
   2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
   3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.4 WATER METER INSTALLATION

A. Install water meter enclosure(s) and specialties as required to prepare meter enclosure(s) for meter installation by Utility Owner. Contact Utility Owner to coordinate installation of water meter.

3.5 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install per requirements of AHJ.

3.6 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, nonrising-stem, resilient-seated gate valves with valve box.
2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
3. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.7 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.8 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.9 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. The Contractor shall perform field tests and provide labor, equipment and incidentals required for testing.

B. Hydrostatic Tests

1. Testing shall be accomplished pursuant to Section 4 of AWWA C-600.
2. To be required after backfill of mains and before pavement repairs. Each section of pressure line constructed shall be tested with a hydraulic test pressure of not less than 150-psi over a continuous period of not less than two hours.
3. During the filling of the mains, and before applying the test pressure, all air shall be expelled from the mains. The Contractor shall furnish adequate equipment to make these tests. The test pressure shall not be allowed to fall below 140-psi, at which pressure the pump will be started and the line loss measured directly by tank measurement or read off of a totalizing meter.
4. Re-pressurizing shall be done each hour, or sooner, as may be required to maintain the test pressure within the prescribed limits. The final re-pressurizing will be made at the end of the final hour of the test. Total water used will be the sum of the quantities required to re-pressurize the line to the original test pressure.
5. 100% of the private water lines laid will be tested. New private service lines will be tested up to the meter.
6. If the test indicates a leakage in excess of a rate equal to 10 gallons per inch of diameter of the pipe per mile over a 24-hour period, then the Contractor shall be required to find the leaks and eliminate same. All known leaks shall be stopped, regardless of allowable leakage.

C. Retesting: If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be re-conducted until the results of the tests are within specified allowances. Contractor shall be responsible for the cost of any retests.

D. Prepare reports of testing activities.

3.10 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Materials shall be per the following schedule:

1. Private PVC Installations: Presco Detectable Caution Tape or approved equal, 3-in width, 5-mil thickness with aluminum core, blue with "Caution Buried Water Line Below" inscribed on tape.
2. Private Ductile Iron Installations: Presco Non-detectable Caution Tape or approved equal, 3-in width, 5-mil thickness, blue with "Caution Buried Water Line Below" inscribed on tape.

3.11 CLEANING

A. Domestic Water Supply System: New or repaired water systems shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be that prescribed by the AHJ or in the absence of a prescribed method, the procedure described in either AWWA C651 or AWWA C652 or the following:

1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.
2. The system or part thereof shall be filled with a water/chlorine solution containing not less than 50 parts per million (PPM, mg/L) of chlorine and the system or part thereof shall be valved off and allowed to stand for 24-hours. If a shorter disinfection time is required, the system or part thereof shall be filled with a water/chlorine solution containing not less than 200 PPM (mg/L) of chlorine and allowed to stand for 3-hours.
3. Following the required standing time, the system shall be flushed with clean, potable water until the chlorine is purged form the system.
4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the line.

B. Portion of private water supply system not connected to Domestic Water Supply System: Use purging and disinfecting procedure prescribed by authorities having jurisdiction or if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

C. Submit water sample sterile bottled to AHJ as required.

D. Prepare reports of purging and disinfecting activities.

END OF SECTION 22 1113

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

B. Related Requirements:

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 PEX TUBE AND FITTINGS

A. PEX Distribution System: ASTM F 877, SDR 9 tubing.

B. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.

C. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:
1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:
1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install domestic water piping level sloped to the isolation drain for seasonal shutoff.

C. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

G. Install piping to permit valve servicing.

H. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install PEX piping with loop at each change of direction of more than 90 degrees.

L. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump.

M. Install thermostats in hot-water circulation piping.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 0518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

E. Joints for PEX Piping: Join according to ASTM F 1807.

F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:
1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
   1. Vertical Piping: MSS Type 8 or 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.

E. Install hangers for vertical PEX piping every 48 inches.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
   2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 0553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.

b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:
1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Aboveground domestic water piping, NPS 3 and smaller, shall be the following:
1. Hard copper tube, ASTM B 88, Type L; copper, solder-joint fittings; and soldered joints.
2. PEX tube, NPS 1 and smaller; fittings for PEX tube; and crimped joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.

2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SECTION 22 1313 – FACILITY SANITARY SEWERS

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 sanitary sewer piping and related components outside the building(s) which are to be retained by the Owner as private improvements at the completion of the project.

1.3 RELATED SECTIONS

A. Section 31 2000: Earth Moving.

1.4 REFERENCED STANDARDS

A. Latest version or edition shall apply unless otherwise noted.
   1. ASTM International
      a. A48, Standard Specifications for Gray Iron Castings.
      b. C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gasket.
      c. C890, Standard Practice for Minimum Structural Design Loading For Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
      d. C891, Standard Practice for Installation of Underground Precast Concrete Utility Structures.
      e. C913, Standard Specification for Precast Concrete Water and Wastewater Structures.
      f. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
      g. C990, Standard Specification for Joints for Concrete Pipe, Manholes and Precast Cox Sections Using Preformed Flexible Joint Sealants.
      h. C1173, Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
      i. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
      j. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
      k. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
      l. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
      m. D2665, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.
      n. D2774, Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
      o. D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fitting.
      p. D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
      q. F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
      r. F1688, Standard Guide for Construction Procedures for Buried Plastic Pipe.
   2. American Water Works Association (AWWA)
      a. C219, Bolted, Sleeve-Type Couplings for Plain-End Pipe.
      b. C600, Standard for Installation of Ductile-Iron Water Mains and their Appurtenances.
      c. M23, PVC Pipe-Design and Installation.

1.5 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.

B. AHJ: Authority having jurisdiction.
   1. City of Tulsa, Building Department
      a. Construction materials
      b. Inspection and testing requirements
   2. Oklahoma Department of Environmental Quality
      a. Permitting and state regulatory requirements.

C. IPC: International Plumbing Code.

D. PVC: Polyvinyl Chloride.

E. SDR: Standard Dimension Ratio.

F. Utility Owner: Owner of existing sanitary sewer collection system.
   1. City of Tulsa

1.6 ACTION SUBMITTALS

A. Shop Drawings: For all pre-cast structures used in completing the indicated scope of work. Include plans, elevations, sections, details and frames and covers.

1.7 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions:
   1. Written authorization from the Utility Owner.
   2. Written authorization from Owner.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS FOR GRAVITY APPLICATIONS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. JM Eagle.

B. Piping: Unplasticized PVC Type Gravity Sewer pipe with integral bell and spigot joints for the conveyance of domestic sanitary sewage. All pipe shall meet the requirements of ASTM D3034 for NPS 4 through NPS 15 and ASTM F679 for NPS 18 through NSP 36. The pipe shall be colored green for in-ground identification as sewer pipe. All pipe shall be made from quality PVC resin, compounded to provide physical and mechanical properties that equal or exceed cell class 12454 or 12364 as defined in ASTM D1784.
   1. Stiffness: All pipe shall have a maximum SDR of 35. Minimum pipe stiffness at 5% deflection shall be 46-psi.

C. Joints: Provisions shall be made for expansion and contraction at each joint. The bell shall consist of an integral wall section with an elastomeric gasket which meets the requirements of ASTM F477. Gaskets shall be factory assembled and securely locked in place to prevent displacement during assembly. The joint design shall meet requirements of ASTM D3212 under both pressure and 22-in Hg vacuum.

D. Fittings: All fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal and have bell and/or spigot configurations compatible with that of the pipe. Requirements for fittings shall be the same as those specified for pipe to pipe joints.

1. Transitions in Pipe Material: Contractor shall provide and install appropriately sized non-pressure transition couplings at any changes in pipe material. Non-pressure couplings shall be as documented in this specification.

2.2 TRANSITION COUPLINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   1. Fernco.

B. Non-Pressure Transition Couplings: Non-pressure couplings shall be of the shielded, flexible variety and shall meet or exceed the requirements of ASTM C1173. Said couplings shall be made of an elastomeric material with a corrosion-resistant shield with tightening devices on each end. Couplings utilized in completion of the scope of work shall be appropriately size and meet all IPC and pipe manufacturer requirements for each type of pipe being joined.

C. Pressure Transition Couplings: Pressure transition couplings shall meet or exceed the requirements of AWWA C219.

2.3 CLEANOUTS

A. Cast-Iron Cleanouts:

   1. Manufacturers: Subject to compliance with requirements:

      a. Josam Company.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.
      d. Tyler Pipe.
      e. Watts Water Technologies, Inc.
      f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
      g. Or approved equal.

   2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

   3. Top-Loading Classification(s): Heavy Duty.
   4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.4 PRIVATE SEWER STRUCTURES

A. Meeting construction Drawing requirements in regards to location, dimensions, depth, invert elevation(s), and rim elevation. Material of construction shall be as indicated on the construction Drawings and shall generally be pre-cast concrete or cast-in-place concrete.

B. Material Substitutions: Subject to review and approval of the Engineer and the following schedule:
   1. Permitted substitutions:
      a. Pre-cast concrete for cast-in-place concrete.
   2. Prohibited substitutions:
      a. Masonry for pre-cast concrete or cast-in-place concrete.

C. Cast-in-place concrete structures:
   1. Concrete: Class A per Section 32 1313.
   2. Reinforcement: Of the size, length and configuration indicated on the Construction Drawings. Reinforcing steel shall be billet or axle steel per Section 32 1313.

D. Pre-cast structures: Pre-cast manhole structures shall meet the requirements of ASTM C478. All other pre-cast concrete structures shall meet the requirements of ASTM C913. All pre-cast

structures shall be designed according to ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 31 2000 "Earth Moving" for excavating, trenching and backfilling.

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. All adjustments subject to review of Engineer.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, Contractor shall use trenchless methodology as required to protect adjacent site feature.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at the slope indicated on the Construction Drawings.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 36-in minimum cover.
   a. Beneath Paved Areas: Contractor shall set top of pipe as required to ensure pipe will be protected during sub-grade preparation. A minimum vertical separation of 24-in shall be maintained between the bottom of the proposed sub-grade section and the top of the proposed sewer line. Contractor shall coordinate work as required.
   b. Field Adjustments: Adjustments in vertical alignment of pipe are subject to the review and approval of Engineer. In no case shall distance form finished grade to top of proposed pipe be less than 36-in.
4. Install PVC Type PSM sewer piping according to ASTM D2321.

G. All installations shall meet the requirements of IPC, latest edition.

H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Install fittings and riser pipe so cleanouts provide access to all portions of proposed sanitary sewer collection system.

B. Installations in Landscaped Areas: Cleanout frames and covers shall be protected by a cast-in-place concrete pad. Dimensions of pad shall be 18-in x 18-in x 6-in, minimum. Top of cleanout and associated pad to be set 1 inch above surrounding grade.

C. Installations in Flexible Paving Areas: Cleanout frames and covers shall be protected by a cast-in-place concrete pad. Dimensions of pad shall be 18-in x 18-in in plan. Concrete pad depth shall match thickness of adjacent flexible paving. Top of cleanout and associated pad to be set flush with finished elevation of surrounding flexible paving.

D. Installations in Hardscape Areas: Set cleanout frames and covers in pavement with top flush to finished grade. Access housing shall be installed prior to completion of surrounding concrete pours.

3.4 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains.
   1. Contractor responsible for coordinating private sanitary sewer improvements with building systems. Location and elevation of connection point at building face shall be confirmed prior to initiating work.

B. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   2. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.5 PRIVATE STRUCTURE INSTALLATION

A. Cast-in-Place Concrete Structures: Complete construction per requirements of ACI 318.

B. Pre-Cast Structures: Install structure per requirements of ASTM C891.

3.6 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground sanitary sewer piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 31 2000 "Earth Moving".

3.7 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect not less than 30-days after final backfill has been put in place.
   1. Submit separate report for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 95 percent of piping diameter. Test to be performed without mechanical pulling device.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Re-inspect and repeat procedure until results are satisfactory.
   5. Costs associated with repair, replacement and re-testing of sanitary sewer system shall be performed at no cost to the Owner.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    a. Fill sewer piping with water. Test with pressure of at least 2-foot head of water.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.
    f. Leakage into or out of pipe shall not exceed 10-gallons per inch of diameter per mile per day.

C. Leaks constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.8 CLEANING

A. Clean dirt and superfluous material from interior of piping.

B. Cleaning of all sanitary sewer improvements shall be completed by Contractor prior to final inspection and acceptance of improvements by Owner.

END OF SECTION 22 1313

SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For sovent drainage system. Include plans, elevations, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, 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. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

C. Heavy-Duty, Hubless-Piping Couplings:
1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.
1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Solvent Cement: ASTM D 2564.
1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 SPECIALTY PIPE FITTINGS

A. Dielectric Fittings:
1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
a. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

a. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig minimum at 180 deg F.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

a. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

a. Description:

1) Standard: IAPMO PS 66
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig at 225 deg F.
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not

change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install aboveground PVC piping according to ASTM D 2665.

N. Install force mains at elevations indicated.

O. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 22 1319 "Sanitary Waste Piping Specialties."
2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 1319 "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 0518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

F. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

G. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
4. Vertical Piping: MSS Type 8 or Type 42, clamps.
5. Install individual, straight, horizontal piping runs:
a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
7. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install supports for vertical cast-iron soil piping every 15 feet.

F. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.

G. Install supports for vertical PVC piping every 48 inches.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Section 22 1319 "Sanitary Waste Piping Specialties."
6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.5 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.7 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.8 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground, vent piping NPS 4 and smaller shall be the following:
1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; coupled joints.
2. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.

END OF SECTION 22 1316

SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Floor drains.
   3. Air-admittance valves.
   4. Through-penetration firestop assemblies.
   5. Flashing materials.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
   1. Wiring Diagrams: Power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements to be as specified in this set of documents.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:
1. ASME A112.36.2M, Cast-Iron Cleanouts:
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk, plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:
1. ASME A112.36.2M, Cast-Iron Cleanouts:
2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Adjustable Housing Material: Cast iron with threads.
7. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
8. Frame and Cover Shape: Round.
9. Standard: ASME A112.3.1.
10. Size: Same as connected branch.
11. Housing: Stainless steel.
12. Closure: Stainless steel with seal.
13. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:
1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
4. Closure: Countersunk, plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
7. Wall Access: Round, wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:
1. Standard: ASME A112.6.3.
2. Body Material: Gray iron.
3. Top or Strainer Material: Bronze.
4. Top of Body and Strainer Finish: Bronze.
5. Top Shape: Round.
6. Provide with trap primer connection.

2.3 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:
1. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
2. Housing: Plastic.
3. Operation: Mechanical sealing diaphragm.
4. Size: Same as connected fixture or branch vent piping.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:
1. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
2. Size: Same as connected soil, waste, or vent stack.
3. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
4. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
5. Special Coating: Corrosion resistant on interior of fittings.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
1. General Use: 4lb/f^2, 0.0625" thickness.
2. Vent Pipe Flashing: 3lb/f^2, 0.05" thickness.
3. Burning: 6lb/f^2, 0.01" thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
1. General Applications: 1lb/ft^2 or 0.015" thickness.
2. Vent Pipe Flashing: 1lb/ft^2 or 0.01" thickness.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.06" minimum thickness, unless otherwise indicated. Include Z275 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 0.04" minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to 4". Use 4" for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50' for piping 4" and smaller and 100' for larger piping.
   4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
   1. Position floor drains for easy access and maintenance.
   2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
      a. Radius, 30" or Less: Equivalent to 1 percent slope, but not less than ¼" total depression.
      b. Radius, 30" to 60": Equivalent to 1 percent slope.
      c. Radius, 60" or Larger: Equivalent to 1 percent slope, but not greater than 1" total depression.
   3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
   4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

G. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.

H. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

I. Assemble FRP channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

J. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

K. Install fixture air-admittance valves on fixture drain piping.

L. Install stack air-admittance valves at top of stack vent and vent stack piping.

M. Install air-admittance-valve wall boxes recessed in wall.

N. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

O. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

P. Install through-penetration firestop assemblies in plastic conductors at floor penetrations.

Q. Assemble open drain fittings and install with top of hub 1" above floor.

R. Install deep-seal traps on floor drains and other waste outlets, if indicated.

S. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

T. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

U. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

V. Install vent caps on each vent pipe passing through roof.

W. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1" clearance between vent pipe and roof substrate.

X. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

Y. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1" clearance between vent pipe and roof substrate.

Z. Install wood-blocking reinforcement for wall-mounting-type specialties.

AA. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 1316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
1. Lead Sheets: Burn joints of lead sheets 6lb/ft^2, 0.0625" thickness or thicker. Solder joints of lead sheets 4lb/ft^2, 0.0625" thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10", and skirt or flange extending at least 8".
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8" around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8" around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 07 6200 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1319

SECTION 22 1319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. 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. Floor drains.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene.

D. PE: Polyethylene.

E. PP: Polypropylene.

F. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:
1. Standard: ASME A112.6.3.
2. Pattern: Floor drain.
3. Body Material: Gray iron.
4. Seepage Flange: Not required.
5. Anchor Flange: Not required.
6. Clamping Device: Not required.
7. Outlet: Bottom.
8. Top or Strainer Material: Bronze.
9. Top of Body and Strainer Finish: Nickel bronze.
10. Top Shape: Round.
11. Funnel: Not required.
12. Inlet Fitting: Not required.
13. Trap Material: Bronze.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
   1. Position floor drains for easy access and maintenance.
   2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
   3. Set with grates depressed according to the following drainage area radii:
      a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
      b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
      c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
   4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
      a. Maintain integrity of waterproof membranes where penetrated.
   5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 1316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 22 1319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1319

SECTION 22 3400 - FUEL-FIRED, INSTANTANEOUS DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Commercial, instantaneous gas-fired, domestic-water heaters.
2. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:
1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

B. Source quality-control reports.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:
1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including storage tank and supports.
      b. Faulty operation of controls.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Periods: From date of Substantial Completion.
      a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
         1) Storage Tank: Three years.
         2) Controls and Other Components: One year.

PART 2 - PRODUCTS

2.1 COMMERCIAL, INSTANTANEOUS GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Atmospheric, Instantaneous Gas-Fired, Storage, Domestic-Water Heaters:
   1. Standard: ANSI Z21.10.3/CSA 4.3.
   2. Factory-Installed Storage-Tank Appurtenances:
      a. Anode Rod: Replaceable magnesium.
      b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
      c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
      d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
      e. Jacket: Steel with enameled finish.
      f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
      g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
      h. Temperature Control: Adjustable thermostat.
      i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
      j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
   3. Special Requirements: NSF 5 construction.
   4. Manufactures subject to compliance with requirements, quotable manufactures offering products that may be incorporated in the work include:
      1). Navien
      2). Approved equal

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

B. Heat-Trap Fittings: ASHRAE 90.2.

C. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.

D. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

E. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

F. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

G. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 4000 "Quality Requirements" for retesting and reinspecting requirements and Section 01 7300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Instantaneous Domestic-Water Heater Mounting: Install commercial domestic-water heaters on wall.
1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install gas-fired, domestic-water heaters according to NFPA 54.
1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.

2. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.

D. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

F. Fill domestic-water heaters with water.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 22 1116 "Domestic Water Piping."

B. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 4000 "Quality Requirements" for retesting and reinspecting requirements and Section 01 7300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, instantaneous gas-fired, storage, domestic-water heaters.

END OF SECTION 22 3400

SECTION 22 4213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Water closets.
2. Manual flush valves.
3. Toilet seats.
4. Supports.

1.3 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

B. Remote Water Closet: Located more than 30' from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets: Floor mounted, bottom outlet, top spud.
1. Bowl:
a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: V
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Rim Contour: Elongated.

f. Spud Size and Location: 1 ½"; top.
2. Bowl-to-Drain Connecting Fitting: ASME A112.4.3.
3. Flushometer Valve: See plans.
4. Toilet Seat: See plans.
5. Manufacturers:
   a. Kohler
   b. Bradley
   c. Prior approved equal

2.2 MANUAL FLUSH VALVES

A. Manual Flush Valves:
1. Standard: ASSE 1037.
2. Minimum Pressure Rating: 125psi.
3. Features: Include integral check stop and backflow-prevention device.
4. Material: Brass body with corrosion-resistant components.
5. Exposed Flushometer-Valve Finish: Chrome plated.
6. Panel Finish: Chrome plated or stainless steel.
7. Style: Exposed.
8. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
9. Consumption: 1.6 gallons per flush.
10. Minimum Inlet: 1".
11. Minimum Outlet: 1 ¼".
12. Manufacturers:
13. a. Sloan
14. b. Prior approved equal

2.3 TOILET SEATS

A. Toilet Seats:
1. Standard: IAPMO/ANSI Z124.5.
2. Type: See plans.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:
1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:
1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.

2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Manual Flush Valve Installation:
1. Install flush valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flush valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:
1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 22 0518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:
1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flush valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
B. Install protective covering for installed water closets and fittings.
C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4213.13

SECTION 22 4213.16 - COMMERCIAL URINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. 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. Urinals.
2. Flush valves.
3. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals: Wall hung, back outlet, blowout.
1. Fixture:
a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Steel.
c. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
d. Water Consumption: Water saving.
e. Spud Size and Location: NPS 1-1/4; top.
f. Outlet Size and Location: NPS 2; back.
2. Flush Valve: See Plans.
3. Waste Fitting:
a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: NPS 2.

4. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.
5. Manufacturers:
   a. Kohler
   b. Bradley
   c. Prior approved equal

2.2 URINAL FLUSH VALVES

A. Lever-Handle, Flush Valves:
1. Standard: ASSE 1037.
2. Minimum Pressure Rating: 125 psig.
3. Features: Include integral check stop and backflow-prevention device.
4. Material: Brass body with corrosion-resistant components.
5. Exposed Flushometer-Valve Finish: Chrome plated.
6. Panel Finish: Chrome plated or stainless steel.
7. Style: Exposed.
8. Minimum Inlet: NPS 3/4.
9. Minimum Outlet: NPS 3/4.
10. Manufacturers:
    a. Sloan
    b. Prior approved equal

2.3 SUPPORTS

A. Type I Urinal Carrier:
1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:
1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:
1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flush Valve Installation:
1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flush valves for accessible urinals with handle mounted on open side of compartment.

D. Wall Flange and Escutcheon Installation:
1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 22 0518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:
1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4213

SECTION 22 4216.13 - COMMERCIAL LAVATORIES

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. Lavatories.
2. Faucets.
3. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 LAVATORIES

A. Lavatory: Rectangular wall hung.
1. Fixture:
a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: Self-rimming for above-counter mounting.
c. Faucet-Hole Location: Top.
d. Mounting Material: Sealant.
2. Faucet: See plans.
3. Manufacturers:
a. Kohler

b. Prior approved equal

2.2 SUPPORTS

A. Type II Lavatory Carrier:
1. Standard: ASME A112.6.1M.

B. Type III Lavatory Carrier:
1. Standard: ASME A112.6.1M.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:
1. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with 1 ¼" offset and straight tailpiece.

C. Trap:
1. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch thick brass tube to wall; and chrome-plated, brass or steel wall flange.
2. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch thick stainless-steel tube to wall; and stainless-steel wall flange.

2.5 SUPPORTS

A. Type II Lavatory Carrier:
1. Standard: ASME A112.6.1M.

B. Type III Lavatory Carrier:
1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 0518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 0719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4216

SECTION 22 4216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Service basins.
2. Handwash sinks.
3. Sink faucets.
4. Supply fittings.
5. Waste fittings.
6. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins: Terrazzo, floor mounted.
1. Fixture:
a. See plans for details.
2. Mounting: On floor and flush to wall.
3. Manufacturers:
4. a. Williams
5. b. Fiat

2.2 HANDWASH SINKS

A. Handwash Sinks: Steel, wall mounted.
1. See plans for schedule:
2. Manufacturers:
a. Bradley
b. Willoughby
c. Prior approved equal

2.3 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets: Manual type, single-control mixing valve.
1. Commercial, Solid-Brass Faucets.
2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. See plans for details.

2.4 SUPPORTS

A. Type II Sink Carrier:
1. Standard: ASME A112.6.1M.

2.5 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:
1. NPS 3/8.
2. Chrome-plated, rigid-copper pipe.

2.6 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:
1. Size: NPS 1-1/2.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

2.7 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.8 SUPPORTS

A. Water Closet Carrier:
1. Standard: ASME A112.6.1M.
2. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.
1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 22 0523.12 "Ball Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 0518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 22 0719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4216

SECTION 22 4223 - COMMERCIAL SHOWERS

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. Shower faucets.
2. Shower basins.
3. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers and basins.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower faucets to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SHOWER FAUCETS

A. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.

B. Shower Faucets:
1. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.
2. Faucet:
a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
b. Body Material: Solid brass.
c. Finish: Polished chrome plate.
d. Operation: Single-handle, twist or rotate control.

e. Antiscald Device: Integral with mixing valve.
f. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

3. Supply Connections: NPS 1/2.
4. Shower Head:
   a. Standard: ASME A112.18.1/CSA B125.1.
   b. Shower Head Material: Metallic with chrome-plated finish.
   c. Spray Pattern: Adjustable.
5. Manufactures:
   a. Bradley
   b. T&S Brass
   c. Prior approved equal

2.2 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.

B. Examine walls and floors for suitable conditions where showers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions.

B. Install showers level and plumb according to roughing-in drawings.

C. Install water-supply piping with stop on each supply to each shower faucet.
1. Exception: Use ball valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 22 0523.12 "Ball Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Set shower receptors in leveling bed of cement grout.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 22 0518 "Escutcheons for Plumbing Piping."

G. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."

C. Comply with traps and soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of showers, inspect and repair damaged finishes.

B. Clean showers, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of showers for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4223

SECTION 22 4500 - EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. 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. Combination units.

1.3 DEFINITIONS

A. A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.

D. Tepid: Moderately warm.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

PART 2 - PRODUCTS

2.1 COMBINATION UNITS

A. Standard, Plumbed Emergency Shower with Eyewash Combination Units,:
1. Shower:
a. Capacity: Not less than 20 gpm for at least 15 minutes.
b. Supply Piping: NPS 1 with flow regulator and stay-open control valve.
c. Control-Valve Actuator: Pull rod.

d. Shower Head: 8-inch-minimum diameter, chrome-plated brass or stainless steel.
e. Mounting: Pedestal.

2. Eyewash Unit:
   a. Capacity: Not less than 0.4 gpm for at least 15 minutes.
   b. Supply Piping: NPS 1/2 with flow regulator and stay-open control valve.
   c. Control-Valve Actuator: Paddle.
   d. Spray-Head Assembly: Two receptor-mounted spray heads.
   e. Receptor: Chrome-plated brass or stainless-steel bowl.
   f. Mounting: Attached shower pedestal.
   g. Drench-Hose Option: May be provided instead of eyewash unit.
      1) Capacity: Not less than 0.4 gpm for at least 15 minutes.
      2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
      3) Mounting: Bracket on shower pedestal.

3. Manufacturers:
   a. Bradley.
   b. Haws.
   c. Speakman.

2.2 SOURCE QUALITY CONTROL

A. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures. Use ball or gate valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 22 0523.12 "Ball Valves for Plumbing Piping" and Section 22 0523.15 "Gate Valves for Plumbing Piping."
   1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
   2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 22 1116 "Domestic Water Piping."

F. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 22 0518 "Escutcheons for Plumbing Piping."

3.3 CONNECTIONS

A. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 22 1116 "Domestic Water Piping."

B. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:
1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 22 4500

SECTION 22 4716 - DRINKING FOUNTAINS

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 drinking fountains and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of drinking fountain.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Filter Cartridges: Equal to 10 percent of quantity installed for each type and size indicated, but no fewer than 2 of each.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

A. Drinking Fountains: Wall mounted.
1. Standards:
a. Comply with NSF 61 Annex G.
b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
2. Capacities and Characteristics:
a. See plumbing plans.
3. Support: Type I Water Cooler Carrier.
4. Water Cooler Mounting Height: Handicapped/elderly according to ICC A117.1.
5. Manufacturers:
a. Most Dependable Fountains
b. Approved equal

2.2 SUPPORTS

A. Type I Water Cooler Carrier:
1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

C. Install mounting frames, affixed to building construction, and attach recessed, drinking fountains to mounting frames.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 22 0523.12 "Ball Valves for Plumbing Piping."

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 0518 "Escutcheons for Plumbing Piping."

G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 22 0523.12 "Ball Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust drinking fountain temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4716

SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 100 deg F and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.
   1. For motors with 2:1 speed ratio, consequent pole, single winding.
   2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

END OF SECTION 23 0513

SECTION 23 0517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Sleeves.
2. Stack-sleeve fittings.
3. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
1. Underdeck Clamp: Clamping ring with setscrews.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 9200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 6200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.3 SLEEVE SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above Grade:
a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
b. Piping NPS 6 and Larger: Cast-iron wall sleeves.

2. Concrete Slabs-on-Grade:
   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Interior Partitions:
   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 23 0517

SECTION 23 0523.12 - BALL VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Brass ball valves.
2. Bronze ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. ASME B31.1 for power piping valves.
7. ASME B31.9 for building services piping valves.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Refer to HVAC valve schedule articles for applications of valves.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:
1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:
1. Include 2-inch stem extensions.
2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

I. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, One-Piece:
1. Description:
   a. Standard: MSS SP-110.
   b. CWP Rating: 400 psig.
   c. Body Design: One piece.
   d. Body Material: Forged brass.
   e. Ends: Threaded.
   f. Seats: PTFE.
   g. Stem: Brass.
   h. Ball: Chrome-plated brass.
   i. Port: Reduced.

B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim:
1. Description:
   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Two piece.
   e. Body Material: Forged brass.
   f. Ends: Threaded.
   g. Seats: PTFE.
   h. Stem: Brass.
   i. Ball: Chrome-plated brass.
   j. Port: Full.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, One-Piece with Bronze Trim:
1. Description:
   a. Standard: MSS SP-110.
   b. CWP Rating: 400 psig.
   c. Body Design: One piece.
   d. Body Material: Bronze.
   e. Ends: Threaded.
   f. Seats: PTFE.
   g. Stem: Bronze.
   h. Ball: Chrome-plated brass.

i. Port: Reduced.

B. Bronze Ball Valves, Two-Piece with Full Port and Bronze or Brass Trim:
1. Description:
a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 23 0553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

3.4 PIPING VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Brass or bronze ball valves, one piece, with brass trim, and full port.
1. Valves may be provided with solder-joint ends instead of threaded ends.

B. Pipe NPS 2-1/2 and Larger:
1. Iron ball valves, Class 125.

a. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

END OF SECTION 23 0523

SECTION 23 0523.14 - CHECK VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Bronze lift check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Block check valves in either closed or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder joint.
4. ASME B31.1 for power piping valves.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE LIFT CHECK VALVES

A. Bronze Lift Check Valves with Bronze Disc, Class 125:
1. Description:
   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig.
   c. Body Design: Vertical flow.
   d. Body Material: ASTM B 61 or ASTM B 62, bronze.
   e. Ends: Threaded.
   f. Disc: Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:
1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements for valve tags and schedules in Section 23 0553 "Identification for HVAC Piping and Equipment."

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules.

3.5 PIPING VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze swing check valves with bronze disc, Class 125.

B. Pipe NPS 2-1/2 and Larger:
1. NPS 2-1/2 to NPS 4: Iron valves may be provided with threaded ends instead of flanged ends.

END OF SECTION 23 0523.14

SECTION 23 0523.15 - GATE VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Bronze gate valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. NRS: Nonrising stem.

C. OS&Y: Outside screw and yoke.

D. RS: Rising stem.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate valves closed to prevent rattling.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.

5. ASME B31.1 for power piping valves.
6. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. RS Valves in Insulated Piping: With 2-inch stem extensions.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE GATE VALVES

A. Bronze Gate Valves, NRS, Class 125:
1. Description:
   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig.
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded.
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron.

B. Bronze Gate Valves, NRS, Class 150:
1. Description:
   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 300 psig.
   c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
   d. Ends: Threaded.
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 23 0553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
1. Shutoff Service: Gate valves.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends, except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends, except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

3.5 PIPING VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze valves, NRS, Class 125, with soldered ends.

B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS, Class 125.

END OF SECTION 23 0523.15

SECTION 23 0523.16 - PLUG VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Lubricated plug valves.
2. Eccentric plug valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set plug valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B31.1 for power piping valves.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Types: Wrench. Furnish Owner with one wrench for every 10 plug valves, for each size square plug-valve head.

2.2 LUBRICATED PLUG VALVES

A. Class 125, Lubricated Plug Valves with Threaded Ends:
1. Description:
a. Standard: MSS SP-78, Type I single gland.
b. NPS 2-1/2 to NPS 4, CWP Rating: 200 psig.
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular.
e. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Lubricated Plug Valves with Flanged Ends:
1. Description:
a. Standard: MSS SP-78, Type I single gland.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
e. Pattern: Regular.
f. Plug: Cast iron or bronze with sealant groove.

2.3 ECCENTRIC PLUG VALVES

A. 175 CWP, Eccentric Plug Valves with Resilient Seating.
1. Description:
a. Standard: MSS SP-108.
b. CWP Rating: 175 psig minimum.
c. Body and Plug: ASTM A 48/A 48M, gray iron; ASTM A 126, gray iron; or ASTM A 536, ductile iron.
d. Bearings: Oil-impregnated bronze or stainless steel.
e. Ends: Flanged.
f. Stem-Seal Packing: Asbestos free.
g. Plug, Resilient-Seating Material: Suitable for potable-water service unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for plug valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install valve tags. Comply with requirements for valve tags and schedules in Section 23 0553 "Identification for HVAC Piping and Equipment."

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
1. Shutoff Service: Plug valves.

B. If valves with CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. Select valves with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

3.5 VALVE SCHEDULE

A. All pipe sizes:
1. Lubricated Plug Valves: Class 125, regular gland, threaded.
2. Eccentric Plug Valves: 175 CWP, resilient seating.

END OF SECTION 23 0523.16

SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.

B. Related Sections:
1. Section 05 5000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 23 3113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
2. Metal framing systems.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. 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.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal 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 the building structure.

B. Metal 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 for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. 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.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. 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.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:
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 allowed by 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: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; 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 so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09 9123 "Interior Painting"

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in 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 carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
3. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
6. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
7. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of
9. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 0529

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

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 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

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.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

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 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include 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.

2.5 STENCILS

A. Stencils for Piping:
1. Lettering Size: Size letters according to ASME A13.1 for piping.
2. Stencil Material: Aluminum.
3. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
4. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

B. Stencils for Ducts:
1. Lettering Size: Minimum letter height of 1-1/4 inches for viewing distances up to 15 feet and proportionately larger lettering for greater viewing distances.
2. Stencil Material: Aluminum.
3. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
4. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.

C. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:
1. Lettering Size: Minimum letter height of 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
2. Stencil Material: Aluminum.
3. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
4. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.

2.6 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. 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.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety-yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 09 9123 "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:
1. Heating Water Piping: White letters on a safety-green background.

3.5 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
1. Yellow: For hot-air supply ducts.
2. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Stenciled Duct Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.

C. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 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 Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
a. Gas: 1-1/2 inches, square.

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 0553

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems:
      a. Constant volume systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
   1. Minimum Agenda Items:
      a. The Contract Documents examination report.
      b. The TAB plan.
      c. Needs for coordination and cooperation of trades and subcontractors.
      d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:
1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC NEBB or TABB.
1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC NEBB or TABB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify

that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan curves.
1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:
1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
1. Airside:
a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.

d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Automatic temperature-control systems are operational.
g. Ceilings are installed.
h. Windows and doors are installed.
i. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 3300 "Air Duct Accessories."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 23 3113 "Metal Ducts."

3.6 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.7 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:
1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.8 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.9 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.
6. Position of balancing devices.

E. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.
    g. Sheave make, size in inches, and bore.
    h. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Motor Data:
    a. Motor make, and frame type and size.
    b. Horsepower and rpm.

c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

F. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:
a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

G. Air-Terminal-Device Reports:

1. Unit Data:
a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

H. Instrument Calibration Reports:

1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.

B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:
1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 0593

SECTION 23 1123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Pipes, tubes, and fittings.
2. Piping and tubing joining materials.
3. Valves.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:
1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

C. Natural-Gas System Pressure exterior to building: 5 psig or less.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following:
1. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
2. Dielectric fittings.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to other nearby facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Architect, Construction Manager and Owner no fewer than two days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Construction Manager's and Owner's written permission.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
3. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

B. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
   a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
   b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.
   c. Aboveground Portion: PE transition fitting.
   d. Outlet shall be threaded or flanged or suitable for welded connection.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
4. Transition Service-Line Risers: Factory fabricated and leak tested.
   a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
   b. Outlet shall be threaded or flanged or suitable for welded connection.
   c. Bridging sleeve over mechanical coupling.
   d. Factory-connected anode.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
5. Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.
   a. PE body with molded-in, stainless-steel support ring.
   b. Buna-nitrile seals.
   c. Acetal collets.
   d. Electro-zinc-plated steel stiffener.
6. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   a. Fiber-reinforced plastic body.
   b. PE body tube.
   c. Buna-nitrile seals.
   d. Acetal collets.
   e. Stainless-steel bolts, nuts, and washers.
7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   a. Steel flanges and tube with epoxy finish.
   b. Buna-nitrile seals.
   c. Steel bolts, washers, and nuts.
   d. Factory-installed anode for steel-body couplings installed underground.

2.2 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.

6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Body: Bronze, complying with ASTM B 584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.
1. Body: Bronze, complying with ASTM B 584.
2. Plug: Bronze.
3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Operator: Square head or lug type with tamperproof feature where indicated.
5. Pressure Class: 125 psig.
6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Valve Boxes:
1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.3 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Description:
   a. Standard: ASSE 1079.
   b. Pressure Rating: 150 psig.
   c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.4 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective

jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 24 inches below finished grade.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:
1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Install fittings for changes in direction and branch connections.

3.4 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

P. Connect branch piping from top or side of horizontal piping.

Q. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

R. Do not use natural-gas piping as grounding electrode.

S. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

T. Install sleeves for piping penetrations of walls, ceilings, and floors.

U. Install sleeve seals for piping penetrations of concrete walls and slabs.

V. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.5 VALVE INSTALLATION

A. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

B. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:
1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 HANGER AND SUPPORT INSTALLATION

A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Section 23 0553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

A. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars and piping specialties, except components, with factory-applied paint or protective coating.
1. Alkyd System: MPI EXT 5.1D.
a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (flat).
d. Color: Yellow.

B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be the following:
1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

B. Aboveground natural-gas piping shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.

3.14 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
1. Two-piece, regular-port, bronze ball valves with bronze trim.

B. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be the following:

1. Two-piece, regular-port, bronze ball valves with bronze trim.

C. Valves in branch piping for single appliance shall be the following:
1. Bronze plug valve.

END OF SECTION 23 1123

SECTION 23 3113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:
1. Section 23 0593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 3300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 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. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:
1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Speakers.
   d. Sprinklers.
   e. Access panels.
   f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable

sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static- pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Where shown on drawings, duct is to be constructed of PVC.

2.4 SEALANT 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. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. 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.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. 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.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. 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.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 23 3300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
1. Where practical, install concrete inserts before placing concrete.
2. 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 "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "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.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 23 3300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:
1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
3. Test for leaks before applying external insulation.
4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum

system design pressure. Do not pressurize systems above maximum design operating pressure.

5. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

2. 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."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed $2x10^{-6}lb/ft^2$.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 3300 "Air Duct Accessories" for access panels and doors.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.

5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes.

7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

A. Air Balance: Comply with requirements in Section 23 0593 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Supply Ducts:
1. Ducts Connected to Air-Handling Units:
a. Pressure Class: Positive 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 3.
d. SMACNA Leakage Class for Round: 3.

C. Return Ducts:
1. Ducts Connected to Air-Handling Units:
a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round: 6.

D. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
a. Pressure Class: Negative 1-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round: 6.

E. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
a. Velocity 1000 fpm or Lower:
1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.
b. Velocity 1000 to 1500 fpm:
1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
c. Velocity 1500 fpm or Higher:
1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.

b. Velocity 1000 to 1500 fpm: Conical tap.

c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 3113

SECTION 23 3116 - NONMETAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Retain or delete this article in all Sections of Project Manual. 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. PVC ducts and fittings.

B. Related Sections:
1. Retain Sections in subparagraphs below that contain requirements Contractor might expect to find in this Section but are specified in other Sections.
2. Section 23 0593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for nonmetal ducts.
3. Section 23 3113 "Metal Ducts" for single- and double-wall, rectangular and round ducts.
4. Section 23 3300 "Air Duct Accessories" for dampers, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Retain first paragraph below if Contractor is required to assume responsibility for duct construction design.

B. Retain paragraph below to comply with sustainable design systems.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
1. PVC duct materials.

1.5 INFORMATIONAL SUBMITTALS

A. Retain first paragraph below if Drawings do not include detailed plans or if Project involves unusual coordination requirements.

B. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Items penetrating finished ceiling including the following:
a. Lighting fixtures.

b. Air outlets and inlets.
c. Access panels.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Retain one of first two paragraphs below if shop or field welding is required. If retaining, also retain "Welding certificates" Paragraph in "Informational Submittals" Article. Retain first paragraph if only one AWS standard is applicable. Retain second paragraph if more than one AWS standard is referenced.

B. Retain first two paragraphs below for sustainable design systems or if requiring compliance with ASHRAE or ASHRAE/IESNA.

C. Retain "ASHRAE Compliance" Paragraph below for sustainable design systems, which require compliance with requirements in ASHRAE 62.1.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

E. Retain "ASHRAE/IESNA Compliance" Paragraph below for sustainable design systems, which require compliance with requirements in ASHRAE/IESNA 90.1.

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

G. NFPA Compliance:
1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.7 PRODUCTS

1.8 PVC DUCTS AND FITTINGS

A. Duct and Fittings:
1. Round Duct: Comply with cell Classification 12454-B in ASTM D 1784, with external loading properties of ASTM D 2412.
2. Round Fittings: Socket end molded of same material, pressure class, and joining method as duct.

B. Verify minimum thickness in subparagraph below with manufacturer. Thickness varies with manufacturer and duct size.

C. Fabrication:
1. Fabricate joints, seams, transitions, reinforcement, elbows, branch connections, and access doors and panels according to SMACNA's "Thermoplastic Duct (PVC) Construction Manual," Chapter 3, "Standards of Construction for PVC Duct Systems."
2. Fabricate 90-degree rectangular mitered elbows to include turning vanes, 90-degree round elbows with a minimum of three segments for 12 inchesand smaller and a minimum of five segments for 14 inches and larger.

1.9 HANGERS AND SUPPORTS

A. Indicate extent of corrosive environment on Drawings.

B. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables: ASTM A 603, galvanized steel with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1.10 EXECUTION

1.11 DUCT INSTALLATION

A. Install ducts with fewest possible joints.

B. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

C. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

D. Install ducts with a clearance of 1 inch plus allowance for insulation thickness.

E. 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. Overlap openings on four sides by at least 1-1/2 inches.

F. Protect duct interiors from the moisture, construction debris and dust, and other foreign materials.

G. Install PVC ducts and fittings to comply with SMACNA's "Thermoplastic Duct (PVC) Construction Manual."

1.12 HANGER AND SUPPORT INSTALLATION

A. Install hangers and supports for PVC ducts and fittings to comply with SMACNA's "Thermoplastic Duct (PVC) Construction Manual," Chapter 3, "Standards of Construction for PVC Duct Systems."

B. Verify attachment selection and spacing in two paragraphs below with structural engineer.

C. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
1. 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. Retain subparagraph below for Projects that require seismic restraints.
6. Do not use powder-actuated concrete fasteners for seismic restraints.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1.13 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Retain first paragraph below for ducts in pressure classes higher than 3-inch wg (750 Pa) or if required for sustainable design systems. It may not be economically practical to test ducts in pressure classes less than 3-inch wg (750 Pa).

C. Leakage Tests:

D. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

E. Test the following systems:

F. Sustainable design systems require compliance with ASHRAE/IESNA 90.1, in which Section 6.4.4.2.2 - "Duct Leakage Tests" requires leak testing of at least 25 percent of total installed duct area with a pressure class in excess of 3-inch wg (750 Pa). Retain first subparagraph below for complying with ASHRAE/IESNA 90.1. To define more stringent requirements, retain subsequent subparagraphs as applicable and delete first subparagraph. Consider cost impact when specifying the extent of duct area to be tested. It is not common to leak test all ducts or ducts with a pressure class less than 3-inch wg (750 Pa).

G. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.

H. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

I. Retain first subparagraph below for field-insulated thermoset FRP or PVC ducts installed outside the building.

J. Test for leaks before applying external insulation.

K. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

L. Retain first paragraph below if duct cleaning is required. Text was taken from NADCA ACR, dated 2005.

M. Sustainable design systems require compliance with ASHRAE 62.1, in which Section 7.2.4 - "Ventilation System Start-up" requires that distribution systems be clean of dirt and debris.

N. Duct System Cleanliness Tests:

O. Visually inspect duct system to ensure that no visible contaminants are present.

P. See Section 01 4000 "Quality Requirements" for retesting and reinspecting requirements and Section 01 7300 "Execution" for requirements for correcting the Work.

Q. Duct system will be considered defective if it does not pass tests and inspections.

R. Prepare test and inspection reports.

1.14 DUCT CLEANING

A. Retain this article for applications where construction dust and debris in duct system must be removed before air-system operation.

B. Sustainable design systems require compliance with ASHRAE 62.1, in which Section 7.2.4 - "Ventilation System Start-up" requires that distribution systems be clean of dirt and debris.

C. Clean duct system(s) before testing, adjusting, and balancing.

D. Use service openings for entry and inspection.

E. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch duct as recommended by duct manufacturer. Comply with Section 23 3300 "Air Duct Accessories" for access panels and doors.

F. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

G. Remove and reinstall ceiling to gain access during the cleaning process.

H. Clean the following components by removing surface contaminants and deposits:

I. Air outlets and inlets (registers, grilles, and diffusers).

J. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

K. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

L. Supply-air ducts, dampers, actuators, and turning vanes.

M. Dedicated exhaust and ventilation components and makeup air systems.

1.15 START UP

A. Air Balance: Comply with requirements in Section 23 0593 "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION 23 3116

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Description: Gravity balanced.

B. Maximum Air Velocity: 2000 fpm.

C. Maximum System Pressure: 3-inch wg.

D. Frame: Hat-shaped, 0.05-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

E. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.

F. Blade Action: Parallel.

G. Blade Seals: Felt.

H. Blade Axles:
   1. Material: Nonferrous metal.
   2. Diameter: 0.20 inch.

I. Tie Bars and Brackets: Aluminum.

J. Return Spring: Adjustable tension.

K. Bearings: Steel ball.

L. Accessories:
1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
   a. Sleeve Thickness: 20 gage minimum.
   b. Sleeve Length: 6 inches minimum.
6. Screen Mounting: Rear mounted.
7. Screen Material: Galvanized steel.
8. Screen Type: Bird.
9. 90-degree stops.

2.4 BAROMETRIC RELIEF DAMPERS

A. Suitable for horizontal or vertical mounting.

B. Maximum Air Velocity: 2000 fpm.

C. Maximum System Pressure: 3-inch wg.

D. Frame: Hat-shaped, 0.05-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

E. Blades:
1. Multiple, 0.025-inch-thick, roll-formed aluminum.
2. Maximum Width: 6 inches.
3. Action: Parallel.
4. Balance: Gravity.
5. Eccentrically pivoted.

F. Blade Seals: Vinyl.

G. Blade Axles: Galvanized steel.

H. Tie Bars and Brackets:
1. Material: Aluminum.
2. Rattle free with 90-degree stop.

I. Return Spring: Adjustable tension.

J. Bearings: Synthetic.

K. Accessories:
1. Flange on intake.
2. Adjustment device to permit setting for varying differential static pressures.

2.5 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
1. Standard leakage rating, with linkage outside airstream.
2. Suitable for horizontal or vertical applications.
3. Frames:
   a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel 0.05-inch-thick stainless steel.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized-steel, 0.064 inch thick.

5. Blade Axles: Galvanized steel.
6. Bearings:
   a. Oil-impregnated bronze.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
7. Tie Bars and Brackets: Galvanized steel.

B. Low-Leakage, Steel, Manual Volume Dampers:
1. Comply with AMCA 500-D testing for damper rating.
2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
3. Suitable for horizontal or vertical applications.
4. Frames:
   a. Hat shaped.
   b. 0.094-inch-thick, galvanized sheet steel.
   c. Mitered and welded corners.
   d. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized, roll-formed steel, 0.064 inch thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
   a. Oil-impregnated bronze.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Blade Seals: Felt.
9. Jamb Seals: Cambered stainless steel.
10. Tie Bars and Brackets: Galvanized steel.
11. Accessories:
    a. Include locking device to hold single-blade dampers in a fixed position without vibration.

2.6 CONTROL DAMPERS

A. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

B. Frames:
1. Hat shaped.
2. 0.094-inch-thick, galvanized sheet steel.
3. Mitered and welded corners.

C. Blades:
1. Multiple blade with maximum blade width of 6 inches.
2. Parallel-blade design.
3. Galvanized-steel.
4. 0.064 inch thick single skin.
5. Blade Edging: Closed-cell neoprene.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:
1. Oil-impregnated bronze.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.7 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
1. Door:
a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

B. Pressure Relief Access Door:
1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 3.0- to 8.0-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.8 DUCT ACCESS PANEL ASSEMBLIES

A. Labeled according to UL 1978 by an NRTL.

B. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

C. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

D. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

E. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.9 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.10 FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

B. Flexible Duct Connectors:
1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Compliance with ASHRAE/IESNA 90.1-2004 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
1. Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

J. Label access doors according to Section 23 0553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

N. Install duct test holes where required for testing and balancing purposes.

O. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 3300

SECTION 23 3416 - CENTRIFUGAL HVAC FANS

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: For each product.
   1. Forward-curved centrifugal fans.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Include rated capacities, furnished specialties, and accessories for each fan.
   2. Certified fan performance curves with system operating conditions indicated.
   3. Certified fan sound-power ratings.
   4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   5. Material thickness and finishes, including color charts.
   6. Dampers, including housings, linkages, and operators.

B. Shop Drawings:
   1. Include plans, elevations, sections, and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.
   4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AMCA Compliance:
1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
2. Operating Limits: Classify according to AMCA 99.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Capacities and Characteristics: See plans for flow information.

D. Acceptable manufacturers:

1. Cook

2. Greenheck

2.2 FORWARD-CURVED CENTRIFUGAL FANS

A. Description:
1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
3. Factory-installed and -wired disconnect switch.

B. Housings:
1. Formed panels to make curved-scroll housings with shaped cutoff.
2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
3. Horizontally split, bolted-flange housing.
4. Spun inlet cone with flange.
5. Outlet flange.

C. Forward-Curved Wheels:
1. Black-enameled or galvanized-steel construction with inlet flange, backplate, shallow blades with inlet and tip curved forward in direction of airflow.
2. Mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

D. Shafts:
1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

E. Prelubricated and Sealed Shaft Bearings:
1. Self-aligning, pillow-block-type ball bearings.
2. Ball-Bearing Rating Life: ABMA 9, LI0 at 50,000 hours.
3. Roller-Bearing Rating Life: ABMA 11, LI0 at 50,000 hours.

F. Grease-Lubricated Shaft Bearings:
1. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.

2. Ball-Bearing Rating Life: ABMA 9, LI0 at 50,000 hours.
3. Roller-Bearing Rating Life: ABMA 11, LI0 at 50,000 hours.

G. Grease-Lubricated Shaft Bearings:
1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
2. Ball-Bearing Rating Life: ABMA 9, LI0 at 50,000 hours.
3. Roller-Bearing Rating Life: ABMA 11, LI0 at 50,000 hours.

H. Belt Drives:
1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning.

I. Accessories:
1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
5. Discharge Dampers: Assembly with parallel blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
6. Inlet Screens: Grid screen of same material as housing.
7. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
8. Spark-Resistant Construction: AMCA 99.
9. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
10. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 0513 "Common Motor Requirements for HVAC Equipment."

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Curb Support: Install roof curb on roof structure, level and secure, according to "The NRCA Roofing and Waterproofing Manual," Low-Slope Membrane Roofing Construction Details Section, Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure centrifugal fans on curbs, and coordinate roof penetrations and flashing with roof construction.

E. Unit Support: Install centrifugal fans level on structural curbs. Coordinate wall penetrations and flashing with wall construction.

F. Install units with clearances for service and maintenance.

G. Label fans according to requirements specified in Section 23 0553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 3300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:
1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

9. See Section 23 0593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
10. Remove and replace malfunctioning units and retest as specified above.

D. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 23 3416

SECTION 23 3713.13 - AIR DIFFUSERS

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. Round ceiling diffusers.
2. Rectangular and square ceiling diffusers.

B. Related Requirements:
1. Section 23 3713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Actual size of smallest diffuser indicated.

C. Samples for Initial Selection: For diffusers with factory-applied color finishes. Actual size of smallest diffuser indicated.

D. Samples for Verification: For diffusers, in manufacturer's standard sizes to verify color selected. Actual size of smallest diffuser indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 ROUND CEILING DIFFUSERS

A. See plans for diffuser schedule.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Acceptable manufacturers:

1. Titus

2. Price

2.2 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. See plans for diffuser schedule.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Acceptable manufacturers:

1. Titus

2. Price

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 3713.23 - AIR REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Adjustable blade face registers and grilles.
2. Fixed face registers and grilles.

B. Related Requirements:
1. Section 23 3713.13 "Air Diffusers" for various types of air diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Smallest size register and grille indicated.

C. Samples for Initial Selection: For registers and grilles with factory-applied color finishes. Smallest size register and grille indicated.

D. Samples for Verification: For registers and grilles, in manufacturer's standard sizes to verify color selected. Smallest size register and grille indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 REGISTERS AND GRILLES

A. Adjustable Blade Face Register: See plans for register and grille details.

B. Fixed Face Register: See plans for register and grille details.

C. Acceptable manufacturers:

1. Titus

2. Price

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 3713

SECTION 23 5533.16 - ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes gas-fired unit heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of gas-fired unit heater.
1. Include rated capacities, operating characteristics, and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Structural members to which equipment will be attached.
2. Items penetrating roof.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace heat exchanger of gas-fired unit heater that fails in materials or workmanship within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. QMark

B. Modine

C. Marker

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Capacities and Characteristics:

C. 1. See plans for operating characteristics.

2.3 MANUFACTURED UNITS

A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.

B. Type of Venting: Gravity vented.

C. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.
1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
2. Discharge Louvers: Independently adjustable, horizontal blades.

D. Propeller Unit Fan:
1. Formed-steel propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.
2. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.

E. Motors:
1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors.
2. Enclosure Materials: Rolled steel.

F. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
1. Control transformer.
2. High Limit: Thermal switch or fuse to stop burner.
3. Wall-Mounted Thermostat:

a. Single stage.

b. Fan on-off-automatic switch.

c. 24-V ac.

d. 50 to 90 deg F operating range.

G. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION

3.1 EQUIPMENT MOUNTING

A. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:
1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify bearing lubrication.
3. Verify proper motor rotation.
4. Test Reports: Prepare a written report to record the following:

a. Test procedures used.

b. Test results that comply with requirements.

c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust initial temperature set points.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain unit heaters.

END OF SECTION 23 5533.16

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 and Type XHHW-2.

D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway. Metal-clad cable, Type MC may be used in lengths not exceeding 3ft for final connections to light fixtures where allowed by NEC.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

H. VFC Output Circuits: Type XHHW-2 in metal conduit.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.

a. Test all branch circuits in the same manner as feeders.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.

b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.

2. Results that comply with requirements.

3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:
   1. Underground distribution grounding.
   2. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
   1. Test wells.
   2. Ground rods.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inchholes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 0543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
2. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven

and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
3. Substations and Pad-Mounted Equipment: 5 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 0526

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   2. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inchand smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 0529

SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways.
5. Boxes, enclosures, and cabinets.

B. Related Requirements:
1. Section 26 0543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 27 0528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Allied Tube & Conduit; a part of Atkore International.
2. Republic Conduit.
3. Robroy Industries.
4. Thomas & Betts Corporation, A Member of the ABB Group.
5. Western Tube and Conduit Corporation.
6. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. IMC: Comply with ANSI C80.6 and UL 1242.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. FMC: Comply with UL 1; aluminum.

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:
   a. Material: Steel.
   b. Type: Setscrew.
2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. CANTEX INC.
2. RACO; Hubbell.
3. Thomas & Betts Corporation, A Member of the ABB Group; ENT Flexible Raceway.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. B-line, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 3R unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. EGS/Appleton Electric.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Hubbell Incorporated.
4. Milbank Manufacturing Co.
5. RACO; Hubbell.
6. Thomas & Betts Corporation, A Member of the ABB Group.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

E. Metal Floor Boxes:
1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

K. Cabinets:
1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: IMC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: IMC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:
1. Run conduit larger than 1-inchtrade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to RNC, Type EPC-40-PVC, before rising above floor.

J. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for raceways.

2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lbtensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Surface Raceways:
1. Install surface raceway with a minimum 2-inchradius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds

25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.

b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.

c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Locate boxes so that cover or plate will not span different building finishes.

BB. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom, for pipe less than 6 inches in nominal diameter.

2. Install backfill.

3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill

to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.

4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.

b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Underground Warning Tape: Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.5 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.6 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 0533

SECTION 26 0543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Direct-buried conduit, ducts, and duct accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include duct-bank materials, including separators and miscellaneous components.
2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include warning tape.

1.4 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.6 FIELD CONDITIONS

A. Ground Water: Assume ground-water level is 36 inches below ground surface unless a higher water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

A. Comply with ANSI C2.

2.2 CONDUIT

A. RNC: NEMA TC 2,

2.3 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Underground Plastic Utilities Duct: NEMA TC 6 & 8, ASTM F 512, Type DB-60-PVC and Type DB-120-PVC, for direct burial, with matching fittings complying with NEMA TC 9 by same manufacturer as the duct.

C. Duct Accessories:
1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Section 26 0553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

3.2 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.

B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.

3.3 EARTHWORK

A. Excavation and Backfill: Do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section "Sodding" and Section 32 9300 "Plants."

3.4 DUCT INSTALLATION

A. Install ducts according to NEMA TCB 2.

B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.

C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.

D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

E. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

F. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

G. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psighydrostatic pressure.

H. Pulling Cord: Install 100-lbf-test nylon cord in empty ducts.

I. Direct-Buried Duct Banks:

1. Excavate trench bottom to provide firm and uniform support for duct bank.
2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
3. Space separators close enough to prevent sagging and deforming of ducts, with not less than five spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
4. Depth: Install top of duct bank at least 36 inches below finished grade unless otherwise indicated.
5. Set elevation of bottom of duct bank below frost line.
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
8. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction.

a. Place minimum 3 inches of sand as a bed for duct bank. Place sand to a minimum of 6 inches above top level of duct bank.
b. Place minimum 6 inches of engineered fill above concrete encasement of duct bank.

J. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inchincrement of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.5 GROUNDING

A. Ground underground ducts and utility structures according to Section 26 0526 "Grounding and Bonding for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:
1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch-long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.7 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION 26 0543

SECTION 26 0544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Grout.
3. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inchminimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.3 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 9200 "Joint Sealants."

b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inchannular clear space between pipe and sleeve for installing mechanical sleeve seals.

END OF SECTION 26 0544

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1 dentification for raceways.
2 Underground-line warning tape.
3 Warning labels and signs.
4 Equipment identification labels.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PRODUCTS

1.6 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1 Black letters on an orange field.

2 Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

1.7 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1 Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.

2 Printing on tape shall be permanent and shall not be damaged by burial operations.

3 Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1 Comply with ANSI Z535.1 through ANSI Z535.5.

2 Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.

3 Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag: Type I:

1 Pigmented polyolefin, bright-colored, compounded for direct-burial service.

2 Thickness: 4 mils.

3 Weight: 18.5 lb/1000 sq. ft.

4 3-Inch Tensile According to ASTM D 882: 30 lbf, and 2500 psi.

1.8 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1 Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.

2 1/4-inch grommets in corners for mounting.

3 Nominal size, 7 by 10 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

1 Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2 Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

1.9 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch. (For use on switchgear and panel boards).

1.10 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1 Minimum Width: 3/16 inch.

2 Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.

3 Temperature Range: Minus 40 to plus 185 deg F.

4 Color: Black except where used for color-coding.

B. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1 Minimum Width: 3/16 inch.

2 Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.

3 UL 94 Flame Rating: 94V-0.

4 Temperature Range: Minus 50 to plus 284 deg F.

5 Color: Black.

EXECUTION

1.11 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
1 Outdoors: UV-stabilized nylon.
2 In Spaces Handling Environmental Air: Plenum rated.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

H. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

1.12 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
1 Emergency Power.
2 Power.

B. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self- adhesive warning labels.
1 Comply with 29 CFR 1910.145.
2 Identify system voltage with black letters on an orange background.
3 Apply to exterior of door, cover, or other access.
4 For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
a. Power transfer switches.
b. Controls with external control power connections.

C. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1 Labeling Instructions:
a. Indoor Equipment: Adhesive film label with clear protective overlay. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2 Equipment to Be Labeled:
a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive and engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

d. Emergency system boxes and enclosures.
e. Enclosed switches.
f. Enclosed circuit breakers.
g. Push-button stations.
h. Contactors.

END OF SECTION 26 0553

SECTION 26 2416 - PANELBOARDS

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. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Two spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.10 PROJECT CONDITIONS

A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's written permission.
3. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      b. Outdoor Locations: NEMA 250, Type 3R.
   2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
   3. Finishes:
      a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Galvanized steel.
   4. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom. Contractor is to field coordinate locations for incoming lugs to correlate with the feeder design/installation.

C. Phase, Neutral, and Ground Buses:
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
   4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1. Refer to drawings for panelboards required to have surge suppression.

2.3 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other approved manufacturer:
1. General Electric.
2. Square D.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs only. Refer to drawings. Provide circuit breaker main for all panelboards directly connected to the load side of step down transformers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other approved manufacturer:
1. General Electric.
2. Square D.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only. Refer to drawings. Provide circuit breaker main for all panelboards directly connected to the load side of step down transformers.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
3. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Mount top of trim 78 inches

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

F. Install filler plates in unused spaces.

G. 1-inchempty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inchempty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 0553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:
1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:
1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:
1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 2416

SECTION 26 2726 - WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Isolated-ground receptacles.
4. Tamper-resistant receptacles.
5. Weather-resistant receptacles.
6. Snap switches and wall-box dimmers.
7. Cord and plug sets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Hubbell Incorporated; Wiring Device-Kellems; Wiring Device-Kellems (Hubbell).
2. Leviton Manufacturing Co., Inc.
3. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
1. Description: Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.4 GFCI RECEPTACLES

A. General Description:
1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc; 7590.
   c. Pass & Seymour/Legrand (Pass & Seymour); 2095.

2.5 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 30 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-30R, and UL 498. Refer to drawings for other specific configurations required.

2.6 CORD AND PLUG SETS

A. Description:
1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Single Pole:
      1) Cooper; AH1221.
      2) Hubbell; HBL1221.
      3) Leviton; 1221-2.
      4) Pass & Seymour; CSB20AC1.
   b. Three Way:
      1) Cooper; AH1223.
      2) Hubbell; HBL1223.
      3) Leviton; 1223-2.
      4) Pass & Seymour; CSB20AC3.
   c. Four Way:
      1) Cooper; AH1224.
      2) Hubbell; HBL1224.
      3) Leviton; 1224-2.

C. Pilot-Light Switches, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; AH1221PL for 120 and 277 V.
   b. Hubbell; HBL1201PL for 120 and 277 V.
   c. Leviton; 1221-LH1.
   d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.
2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; AH1221L.
   b. Hubbell; HBL1221L.
   c. Leviton; 1221-2L.
   d. Pass & Seymour; PS20AC1-L.
2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 1995.
   b. Hubbell; HBL1557.
   c. Leviton; 1257.
   d. Pass & Seymour; 1251.

2.8 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.9 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch-thick, satin-finished, Type 302 stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

C. Chemical Rooms: Provide nylon or other chemical resistant cover plate.

2.10 FINISHES

A. Device Color:
1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inchesin length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 26 0553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

END OF SECTION 26 2726

SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1 Fusible switches.
2 Nonfusible switches.
3 Molded-case circuit breakers (MCCBs).
4 Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
1 Enclosure types and details for types other than NEMA 250, Type 1.
2 Current and voltage ratings.
3 Short-circuit current ratings (interrupting and withstand, as appropriate).
4 Include evidence of NRTL listing for series rating of installed devices.
5 Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6 Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton
2. General Electric.
3. Square D.
4. Siemens.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 0553 "Identification for Electrical Systems."
1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:
1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:
1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
   c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 26 2816

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:
1. Section 26 2726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.8 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.9 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
1. Warranty Period for Emergency Lighting Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. 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.

E. Diffusers and Globes:
1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
   b. UV stabilized.
2. Glass: Annealed crystal glass unless otherwise indicated.

F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp and ballast characteristics:
   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
   c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
   d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
   e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
   f. CCT and CRI for all luminaires.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:
1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.95 or higher.
11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:
1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
   a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
5. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
   a. Battery: Sealed, maintenance-free, nickel-cadmium type.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.

c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.7 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.8 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 85 (minimum), color temperature(see drawings) K, and average rated life 20,000 hours unless otherwise indicated.

B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 85 (minimum), color temperature(see drawings) K, and average rated life of 20,000 hours unless otherwise indicated.

C. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches, 2900 initial lumens (minimum), CRI 85 (minimum), color temperature(see drawings) K, and average rated life of 20,000 hours unless otherwise indicated.

D. T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature(see drawings) K, and average rated life of 20,000 hours unless otherwise indicated.

E. Compact Fluorescent Lamps: 4-Pin, CRI 85 (minimum), color temperature (see drawings) K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated.

1. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
2. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
3. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).

2.9 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 26 0529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inchsteel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:
1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inchmetal channels spanning and secured to ceiling tees.

E. Suspended Lighting Fixture Support:
1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
   1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 26 5100

SECTION 27 0528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Boxes, enclosures, and cabinets.

B. Related Requirements:
1. Section 26 0543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 26 0533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Allied Tube & Conduit; a part of Atkore International.
2. Republic Conduit.
3. Thomas & Betts Corporation, A Member of the ABB Group.
4. Western Tube and Conduit Corporation.
5. Wheatland Tube Company.

B. General Requirements for Metal Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. IMC: Comply with ANSI C80.6 and UL 1242.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
   a. Material: Steel.
   b. Type: Setscrew. Use compression fittings in outdoor or wet locations.
3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

F. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CANTEX INC.
2. Carlon; a brand of Thomas & Betts Corporation.

B. General Requirements for Nonmetallic Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets:
1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed Conduit: IMC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
3. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
4. Concealed within combustible wall ceiling framing: Electrical non-metallic flexible tubing. Minimum size 1 inch.

C. Minimum Pathway Size: 1 inch trade size. Minimum size for optical fiber cables is 1-1/2 inch. Minimum size for Audio-Visual(AV) pathways is 1-1/2 inch.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10. Provide compression fittings when used outdoors or subject to wet conditions.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Pathways Embedded in Slabs:
1. Run conduit larger than 1-inchtrade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-footintervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.

3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to IMC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for pathways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

M. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits of 2-inchtrade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

P. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lbtensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

Q. Surface Pathways:
1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
2. Install surface pathway with a minimum 2-inchradius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 1-InchTrade Size and Larger: Install pathways in maximum lengths of 75 feet.
2. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

T. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

BB. Set metal floor boxes level and flush with finished floor surface.

CC. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom for pipe less than 6 inches in nominal diameter.
2. Install backfill.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 2000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 27 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.5 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.6 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 27 0528

SECTION 31 1000 SITE CLEARING

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

A. Section Includes:
   1. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Stripping and stockpiling topsoil.
   4. Removing above- and below-grade site improvements.
   5. Disconnecting and removing site utilities.
   6. Temporary erosion- and sedimentation-control measures.

B. Related Sections:
   1. Division 01 Section "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities.
   2. Division 02 Section "Selective Structure Demolition" for partial demolition of buildings or structures.

1.03 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

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

1.04 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other 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. Refer also to demolition plan for additional information of items shown for removal.

1.05 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

B. Utility Locator Service: Call Okie (800) 522-6543 before site clearing or excavation.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. (Refer also to Demolition Plan drawings.)

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 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.

3.03 EXISTING UTILITIES

A. Coordinate with Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing. Refer to Demolition Plan drawing for additional information.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, and disconnect utilities indicated to be abandoned in place.

C. Excavate for and remove underground utilities indicated to be removed.

3.04 TREE REMOVAL

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction. As shown on Demolition Plan

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

2. Grind down stumps and remove roots, obstructions, and debris to a depth of 12 inches below exposed subgrade.

B. Fill depressions caused by clearing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. 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.

3.05 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 4 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 60 inches.

3.06 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.07 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. Refer to Demolition Plan for additional information.

B. Do not stockpile waste material in the floodplain.

END OF SECTION 31 1000

SECTION 31 2000 – EARTH MOVING

1) GENERAL

1.1 DESCRIPTION

A. Work includes: Excavate, backfill, compact and grade the site to the elevations shown on the drawings as specified herein and as needed to meet the requirements of the construction shown in the Contract Documents. Import specified materials to achieve grading / elevations per plans. Refer to Drawings and this specification section for specific materials and procedures to fill existing swimming pool.

1.2 QUALITY ASSURANCE

A. 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 of this Section.

B. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.

C. Do not proceed until utility locations are identified.

1.3 SUBMITTALS

A. Provide topsoil source and a 3 lb. sample for each of the following materials:

1. Select Fill.
2. Topsoil.

2) PRODUCTS

2.1 SOIL MATERIALS

A. Select Fill / Structural Fill:

1. The Select Fill shall consist of approved low plasticity material having a plasticity index of 8 to 18 and containing at least 15 percent fines (material passing the No. 200 sieve, based on dry weight) and classifying as lean clay (CL) or clayey sand (SC) per the unified Soil Classification System. All Select Fill materials shall be free of organic matter and debris and contain a maximum rock size of 2 inches. Compact Select Fill to 95% of the material's maximum standard Proctor dry density (ASTM D-698). Select Fill will have a water content range of -2 to +2% of the optimum moisture content.

B. Topsoil & General Fill:

1. For general fill / grading of areas not specified for Select Fill, provide topsoil consisting of friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life and reasonably free from subsoils, roots, heavy or stiff clay, stones larger than 1" in greatest dimension, noxious weeds, sticks, brush, litter and other deleterious matter. The top 12" layer of topsoil in lawn areas shall have no inorganic materials larger than ½" diameter.
2. Provide imported topsoil obtained from sources outside the project limits.

3) EXECUTION

3.1 PROJECT CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

B. Cover holes and trenches when work is not in progress.

C. Traffic: minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

D. Utility Locator Service: Notify "the Oklahoma One Call Okie System" for area where project is located before beginning earth moving operations.

E. Areas within the limits of construction should be stripped and cleared of all surface vegetation and topsoil. Depressions and excavations created during demolition should be cleared of loose material and debris and properly backfilled with tested and approved select fill.

F. After stripping and completing the recommended cuts and over excavations, the subgrade should be proof-rolled to help delineate soft, unstable or disturbed areas. Soft, unstable or otherwise unsuitable soils identified by proof-rolling should be undercut to expose stable material and backfilled with controlled Structural Fill if they cannot be adequately stabilized in-place. After completing the proof-rolling and before placing any fill, the exposed subgrade should be scarified to a minimum depth of 9 inches, moisture conditioned, and compacted.

G. Protect and maintain erosion and sedimentation controls during earth moving operations.

3.2 FINISH ELEVATIONS AND LINES

A. Provide work in accordance with Grading Plan drawing.

3.3 PROCEDURES

A. Utilities:

1. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Owner's Representative and secure his instructions. Field verify location of all existing utilities.

2. Perform new utility work per Drawings.

B. Protection of persons and property:

1. Barricade open holes and depressions occurring as part of this work and post warning lights on property adjacent to or with public access.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

3. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.

C. Dewatering:

1. Remove all water, including rain water, encountered during trench and substructure work to an approved location by pumps, drains and other approved methods.

2. Keep excavations and site construction free from water.

D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

3.4 EXCAVATING

A. Perform excavating of every type of material encountered within the limits of the work to the lines, grades and elevations indicated and specified herein.

B. For existing swimming pool to be removed and filled, refer to Drawings and the following procedures in preparation for filling / backfilling.

D. Satisfactory excavated materials:

1. Transport to, and place fill or embankment areas within the limits of the work.

E. Unsatisfactory excavated materials:

1. Excavate to a distance below grade as directed by the Owner's Representative and replace with satisfactory materials.

2. Include excavation of unsatisfactory materials and replacement by satisfactory materials as parts of the work of this Section.

F. Surplus materials:

1. Dispose of unsatisfactory excavated materials and surplus satisfactory excavated material offsite.

G. Excavate and backfill in a matter and sequence that will provide proper drainage at all times.

H. Unauthorized excavation:

1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific instruction from the Owner's Representative.

2. Under footings, foundations or retaining walls:

a. Fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom without altering the required top elevation.

b. When acceptable to the Owner's Representative, lean concrete fill may be used to bring bottom elevations to proper position.

3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations, unless otherwise directed by the Owner's Representative.

I. Do not use explosives.

J. In areas where over-excavation occurs backfill with Structural Fill and compact as detailed in the Specification.

K. Unauthorized excavation and resulting fill costs shall be borne by the contractor. No payment shall be made by the Owner.

3.5 FILLING AND BACKFILLING

A. Backfill excavations as promptly as progress of the work permits, but not until:

1. Acceptance of construction below finish grade;

2. Inspecting, testing, approving and recording locations of underground utilities;

3. Concrete formwork is removed;

4. Shoring and bracing are removed and voids have been backfilled with satisfactory materials.

5. Trash and debris have been removed.

B. Ground Surface Preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions and deleterious materials from the ground surface prior to placement of fills.

2. Plow, strip or break up surfaces steeper than one vertical to four horizontal so that fill material will bond with existing surface.

3. When existing ground surface has a density less than that specified under "compacting" for the particular area, break up the ground surface, pulverize, moisture condition to the optimum moisture content and compact to required depth and percentage of maximum density.

4. At exposed soils in areas for sidewalks and pool deck, scarify to a minimum depth of 6" and recompact at a moisture content that will permit proper compaction as specified for fill.

C. Existing Swimming Pool Filling:

1. Confirm that pool has been removed per Demolition Plan requirements.

2. In areas where the new pool does not overlap the existing pool, fill existing swimming pool with Select Fill (per definition in this specification), placed in loose lifts not exceeding 9 inches in thickness at a moisture content equal to or slightly above the material's optimum moisture content, and compacted to at least 95 percent of the material's maximum laboratory dry density, determined in accordance with ASTM D-698.

3. Refer to Grading Plan on Drawings for proposed elevations and storm drainage improvements.

4. Provide density testing of each lift, per this specification.

D. Placing and compacting fill:

1. Place backfill and fill materials in layers not more than 9 inches in loose depth.

2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.

3. Compact each layer to required percentage of maximum density for the area.

4. Do not place backfill or fill material on surfaces that are muddy, frozen or containing frost or ice.

5. Place backfill and fill materials evenly adjacent to structures to required elevations.

6. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structures to approximately the same elevation in each lift.

7. Refer to grading plan on Drawings for specific elevations to achieve.

E. Building Pads and subgrade preparation:

1. Pool Building pad:
   i. Refer to structural drawings, provide 12" depth of compacted structural fill, topped with 9" layer of clean granular fill, topped with vapor barrier under the floor slab/footings.
2. Pool pad:
   i. Refer to Pool drawings, compact existing subgrade to 95% proctor density, at a depth of 6", topped with 12" layer of clean ¾" granular fill, under the pool floor slab.
3. Pool Deck/ Sidewalks/ Service Drive:
   i. Refer to drawings, compact existing subgrade or general fill to a depth of 6" compacted to 95% proctor density, top with 4" layer of aggregate base compacted to 95% proctor density under the sidewalk pad.
4. Water Playground:
   i. Refer to drawings, compact existing subgrade to a depth of 6" compacted to 95% proctor density, top with 24" layer of structural fill compacted to 95% proctor density, topped with a 4" layer of compacted aggregate base, under the paving slab.

3.6 GRADING

A. General:

1. Uniformly grade the areas within limits of grading under this Section including adjacent transition areas.

2. Smooth the finished surfaces within specified tolerance.

3. Compact with uniform levels or slopes between points where elevations are shown on the drawings or between such points and existing grades.

4. Finish the surfaces to be free from irregular surface changes, and:

a. Shape the surface of areas scheduled to be under walks to line, grade and cross-section with finished surface not more than 0.10 ft. above or below the required subgrade elevation.

b. Shape the surface of areas scheduled to be under pavement to line, grade, and cross-section, with finished surface not more than 0.05 ft. above or below the required subgrade elevation.

3.7 COMPACTING

A. Control soil compaction during construction to provide the minimum percentage of density specified for each area as determined according to ASTM D1557.

B. Provide not less than the following maximum density of soil material compacted at optimum moisture content for the actual density of each layer of soil material in place:

1. Lawn and unpaved areas:

a. Compact the subgrade and each layer of fill material or backfill material at 90% of maximum density.

b. Compact the upper 12" of filled areas, or natural soils exposed by excavating, at 85% of maximum density.

2. Walks, pool deck slab, building, and water playground:

a. Compact the top 6" of subgrade and each layer of fill material or backfill material at 95% of maximum density (maximum laboratory dry density, in accordance with ASTM D-698).

C. Moisture control:

1. Where subgrade or layer of soil material must be moisture-conditioned before compacting uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during or subsequent to compacting operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.

3. Soil material that has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests approved by the Owner's Representative.

3.8 FIELD QUALITY CONTROL

A. Provide at least the following tests to the Owner, performed by an independent testing laboratory.

1. For swimming pool filling, perform a minimum of three field density tests on the scarified and compacted subgrade per lift of fill.

B. If, in the opinion of the Owner's Representative based on reports of the testing laboratory, subgrade or fills which have been placed are below specified density, provide additional compacting and testing. Receive approval of corrective measures prior to paving operations.

3.9 MAINTENANCE

A. Protection of newly graded areas:

1. Protect newly graded areas from traffic and erosion and keep free from trash and weeds;

2. Repair and re-establish grades in settled, eroded and rutted areas to the specified tolerances.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape and compact to the required density prior to further construction.

END OF SECTION 31 2000

SECTION 31 3116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil treatment with termiticide.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include the EPA-Registered Label for termiticide products.

B. Product certificates.

C. Soil Treatment Application Report: Include the following:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Termiticide brand name and manufacturer.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes used, and rates of application.
   6. Areas of application.
   7. Water source for application.

D. Warranties: Sample of special warranties.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who employs workers trained and approved by manufacturer to install manufacturer's products.

B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.5 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
   1. Warranty Period: Five years from date of Final Acceptance.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.2 APPLYING SOIL TREATMENT

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

C. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
   1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

D. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

E. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

F. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

G. Post warning signs in areas of application.

H. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 31 3116

SECTION 32 1313 CONCRETE PAVING

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

A. Section Includes:

1. Service Drives.
2. Sidewalks and pool deck slabs.

A. Related Sections:

1. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, other pozzolans, and ground granulated blast-furnace slag.

1.04 SUBMITTALS

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

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Ready-Mix-Concrete 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" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: 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.

C. Concrete Testing Service: Engage an AMRL certified testing agency to perform material evaluation tests and to design concrete mixtures.

D. ACI Publications: Comply with ACI 301 unless otherwise indicated.

1.06 PROJECT CONDITIONS

A. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.01 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.02 STEEL REINFORCEMENT

A. Recycled Content: Provide steel reinforcement with an average recycled content of

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

C. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

D. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.03 CONCRETE MATERIALS

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

1. Portland Cement: ASTM C 150, portland cement Type I/II.

B. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source[with documented service-record data of at least 10 years' satisfactory service in similar paving 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.

C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1. Aggregate Sizes: 3/4 to 1 inch (19 to 25 mm) nominal.

D. Water: Potable and complying with ASTM C 94/C 94M.

E. Air-Entraining Admixture: ASTM C 260.

F. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

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

2.04 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182,.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements:
   a. Axim Italcementi Group, Inc.; Caltexol CIMFILM.
   b. BASF Construction Chemicals, LLC; Confilm.
   c. ChemMasters; Spray-Film.
   d. Conspec by Dayton Superior; Aquafilm.
   e. Dayton Superior Corporation; Sure Film (J-74).
   f. Edoco by Dayton Superior; BurkeFilm.
   g. Euclid Chemical Company (The), an RPM company; Eucobar.
   h. Kaufman Products, Inc.; VaporAid.
   i. Lambert Corporation; LAMBCO Skin.
   j. L&M Construction Chemicals, Inc.; E-CON.
   k. Meadows, W. R., Inc.; EVAPRE.
   l. Metalcrete Industries; Waterhold.
   m. Nox-Crete Products Group; MONOFILM.
   n. Sika Corporation, Inc.; SikaFilm.
   o. SpecChem, LLC; Spec Film.
   p. Symons by Dayton Superior; Finishing Aid.
   q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
   r. Unitex; PRO-FILM.
   s. Vexcon Chemicals Inc.; Certi-Vex EnvioAssist.
   t. Or approved equal

2.05 RELATED MATERIALS

A. Joint Fillers: ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements.

D. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch (3 to 6 mm).

1. Products: Subject to compliance with requirements:

a. ChemMasters; Exposee.
b. Conspec by Dayton Superior; Delay S.
c. Dayton Superior Corporation; Sure Etch (J-73).
d. Edoco by Dayton Superior; True Etch Surface Retarder.
e. Euclid Chemical Company (The), an RPM company; Surface Retarder Formula S.
f. Kaufman Products, Inc.; Expose.
g. Meadows, W. R., Inc.; TOP-STOP.
h. Metalcrete Industries; Surftard.
i. Nox-Crete Products Group; CRETE-NOX TA.
j. Scofield, L. M. Company; LITHOTEX Top Surface Retarder.
k. Sika Corporation, Inc.; Rugasol-S.
l. SpecChem, LLC; Spec Etch.
m. TK Products, Division of Sierra Corporation; TK-6000 Concrete Surface Retarder.
n. Unitex; TOP-ETCH Surface Retarder.
o. Vexcon Chemicals Inc.; Certi-Vex Envioset.
p. Or approved equal

2.06 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes (15-mil coverage).
   1. Standard Color: White
   2. ADA marking Color: Blue
   3. Fire Lane Marking Color: Red

2.07 MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
   1. Use a qualified, independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
   2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Compressive Strength (at 28 Days): 3500 psi.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
   3. Slump Limit: 5 inches, plus or minus 1 inch (25 mm).
C. Use of early high strength concrete mix is prohibited.
D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
F. Fly Ash: The use of fly ash as an additive in concrete is prohibited.

2.08 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Furnish batch certificates for each batch discharged and used in the Work.

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

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, 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.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below paving to identify soft pockets and areas of excess yielding.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 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, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap of adjacent mats.

3.05 JOINTS

A. General: Form expansion and control joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at expansion joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Expansion Joints: Form expasion joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals As Shown on Drawings (maximum of 50-feet).
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Control Joints: Form control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Sawed Joints: Form controljoints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inchradius. Repeat tooling of edges after applying surface finishes.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 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 in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.08 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to 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.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by a combination of these:

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 lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or 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 that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.09 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch minus 1/4 inch.
3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout and placement have been verified with Architect.

B. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage an AMRL certified testing agency to perform tests and inspections.

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

1. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. or fraction thereof of each concrete mixture placed each day.

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

2. Slump: ASTM C 143/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, pressure method; 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 and below and when it is 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if 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.

D. 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.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. 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 Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1313

SECTION 32 1316 - DECORATIVE CONCRETE PAVING

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. Work specified in this section includes all labor, materials, equipment and services necessary to complete the stamping, application of color hardener, installation of Bomanite Sandscape concrete finish (or approved equal), and secondary coloration. Including sub-base, formwork, reinforcement, concrete, and jointing.

B. Related Sections include the following:
   1. Section 01 6000 "Product Requirements" for submittals and Substitutions.
   2. Section 32 1313 "Concrete Paving" for concrete slabs.
   3. Section 32 1373 "Concrete Paving Joint Sealants" Installation of caulking

1.3 SUBMITTALS

A. Product Requirements:
   1. Provide submittal information within 35 calendar days after the contractor has received the owner's notice to proceed.

B. Product Data:
   1. Submit specifications, test data and other data required for each type of manufactured material and product indicated.
   2. Submit Technical Bulletins listing product name, descriptive data, curing time and application requirements.
   3. Submit Material Safety Data Sheet (MSDS) and other safety requirements.

C. Field quality-control test and inspection reports.
   1. Documentation by the concrete contractor or General Contractor of the sub-grade compaction results prior to concrete placement.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: The contractor for this work shall be performed by a contractor with at least 5 years' experience installing colored and stamped concrete and at least 10 previous projects with similar specialty concrete work.
   1. Use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary craft.
   2. Applicator shall be familiar with the specified requirements and the methods needed for proper performance of work of this section.

C. Source Limitations:
   1. Concrete: Obtain each type or class of cementitious material of the same brand from same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
   2. Sand: Obtain sand determined suitable for the Bomanite Sandscape Texture (or approved equal) process. Utilize natural colored sand from same manufacturer's plant to meet samples and mock-ups.

D. Mock-ups:
   1. Apply finish to mock-ups, using each type of finish to demonstrate finished appearance and standard of workmanship.
      a. Obtain from Owner and Architect approval of mock-ups before starting construction.
      b. If the Owner and Architect determine that the mock-ups do not meet requirements, General Contractor will demolish and remove them from the site and arrange to assemble more until approved.
      c. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

1.5 DELIVERY, STORAGE AND HANDLING
   A. Deliver materials in original packages and containers, with seals unbroken, bearing labels indicating brand name and directions for storage, mixing with other components and application.

1.6 PROJECT CONDITIONS
   A. Environmental Limitations:
      1. Refer to specification 32 1313 for environmental limitations.
      2. Concrete must be cured a minimum of 14 days or as directed by the manufacturer before trafficking of Bomanite Sandscape Texture can begin.

1.7 PERFORMANCE REQUIREMENTS
   A. The product is required to bear daily foot and vehicular traffic without loss of exposed sand aggregates.
   B. The product is required to have more uniform aggregate exposure than that of sand blasted concrete.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. Surface Deactivator: Water-based reactive compound designed to retard the set of fresh concrete at the surface and holds in the mix water to achieve improved concrete properties.

   B. Coloring agent:
      1. Concentrated dry powder iron oxide pigments by Bomanite (or approved equal) designed to color concrete to meet samples and mock-ups. As noted in colored concrete legend on drawings.
      2. Colors:
         A. Café Au Lait
         B. Painted Desert

   C. Concrete Finish:
      1. All colored concrete to have integral Bomanite Sandscape texture or approved equal.
      2. Natural colored silica sands to be used for Sandscape texture. Submit sample to architect and owner for approval.

   D. Sealing and Finish Coatings:
      1. Seal all colored concrete with Chemical Products CP-500 W or approved equal.

2.2 CONCRETE
   A. Portland cement: shall conform to ASTM C 150, Type I, II or V.
   B. Aggregates: shall conform to ASTM C 33 and be optimized with minimal gap grading and the largest top sized aggregate feasible.
   C. Water: Mixing water shall be fresh, clean and potable.

D. Air Entrainment: Conforming to ASTM C260. In freeze-thaw areas, air entrainment shall be provided.
E. Water-Reducing Admixtures: Water-reducing admixtures and/or super-plasticizers are permitted and shall conform to ASTM C 494.
F. All colored concrete to be integrally colored, with pigment throughout the slab.
G. Pozzolans: Fly Ash may not be used.

2.3 REINFORCING
A. Reinforcing Steel: Conforming to ASTM A615, clean and free of rust, dirt, grease or oils.
B. Tie Wire: 16-gauge plain cold-drawn steel conforming to ASTM A82, clean, and free of rust, dirt, grease or oils.
C. Supports for Reinforcement:
1. Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars in place.
D. Polypropylene Fiber Reinforcement: 100% virgin multifilament polypropylene fibers, complying with ASTM C 1116 - Type III.

2.4 ISOLATION JOINT MATERIALS
A. Refer to Section 32 1373 – Joint Sealants for isolation joint construction.

2.5 CONSTRUCTION JOINT DOWELS
A. Construct construction joints in areas as required- diamond dowels are required to provide load transference at all construction joints
B. Dowel per drawings and specs

2.6 EXPANSION JOINT MATERIALS
A. Provide expansion joints as shown on drawings.

PART 3 – EXECUTION

3.1 SUB-GRADE
A. Sub-grade to meet requirements drawings and details.
B. Ensure that utilities are buried and compacted below bottom of aggregate base.
C. Keep aggregate base damp prior to placing concrete.
D. Consult General Contractor, Landscape Architect, and Concrete Contractor prior to installation of concrete slab to ensure complete understanding of substrate preparation, reinforcement, penetrations, mix design, placing and finishing requirements, elevations, etc.

3.2 FORMING
A. Be responsible for design and engineering of form work as well as its construction.
B. Ensure that work conforms to recommended practice for concrete form work (ACI 347), latest edition.
C. Ensure that form lumber is new #2 or better grade wood or plastic-coated plywood for vertical faces.
D. Allow forms to remain in place long enough restrain the concrete during set and for a minimum of 12 hours after pour.

3.3 CONCRETE MIX SPECIFC TO SANDSCAPE TEXTURE REQUIREMENTS
A. Requirements:
1. Slump: 3 to 5 inch slump. Obtain approval from Owner's Authorized Representative if slump is outside these parameters.

2. Minimum PSI Rating at 28 days: 3,500.
3. Cement quantity per yard of mix:
    a. Minimum: 5 sacks.
    b. Maximum: 7 sacks.
4. Water/cement ratio: Maximum .6.
5. Aggregates: Use maximum 1" top size aggregate.
6. Admixtures:
    a. Air entrainment: As determined required by aggregate size and environment.
    b. Water Reducing: Mid-range water reducers recommended.
7. Fly ash: Do not use

3.4 FINISHING

A. Sandscape Texture:
    1. Before concrete has cured, apply specified surface deactivator.
    2. Allow deactivator to settle on concrete surface for the length recommended by deactivator manufacturer.
    3. Wash off deactivator to reveal etched surface with exposed sand.

3.4 JOINTING

A. Construction and Contraction Joints:
    1. Sawcut construction and expansion joints in locations indicated on drawings.
    2. Perform jointing with a circular saw – walk behind saws are not acceptable unless of the early entry type to maintain required straightness standards.
    3. Joint Width: Per drawings and approved samples. Do not exceed 1/4-inch in width.
    4. Sawcut joints in a straight line with no overcutting. Use a hand tool to sawcut up to vertical edges such as walls, steps, curbs and columns.

B. Isolation Joint Caulking:
    1. Install isolation joint caulking to be installed under Section 32 1373 – Joint Sealants.

3.5 SEALING

A. Treat colored concrete surface once cured with Chemical Products CP500 W per manufacturer's instructions.

3.6 PROTECTION

A. General: Protect finished work from traffic until fully cured in accordance with manufacturer's recommendations.

END OF SECTION 32 1316

SECTION 32 1373 CONCRETE PAVING JOINT SEALANTS

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

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.

B. Related Sections:

1. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Pavement-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

C. Product Certificates: For each type of joint sealant and accessory, from manufacturer.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

E. Preconstruction Compatibility and Adhesion Test Reports: From joint-sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility with and adhesion to joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.05 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As indicated on drawings.

2.02 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.

1. Products: Subject to compliance with requirements:
   a. Crafco Inc., an ERGON company; RoadSaver Silicone.
   b. Dow Corning Corporation; 888.
   c. Pecora Corporation; 301 NS.
   d. Or approved equal.

2.03 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.

1. Products: Subject to compliance with requirements:
   a. Crafco Inc., an ERGON company; Superseal 444/777.
   b. Or approved equal.

2.04 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.05 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place joint sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.04 CLEANING

A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 32 1373

SECTION 32 9200 – SODDING

PART 1 – GENERAL

1.1 SUMMARY

A. Work to include:

1. Fine grading.
2. Fertilizing and sod installation.
3. Refer to Drawings for areas to be sodded. All areas of the site that are disturbed by construction and not shown as plantings are to be sodded.
4. Maintenance until Final Acceptance.

1.2 REFERENCES

ASPA (American Sod Producers Association) - Guideline Specifications to Sodding.

1.3 DEFINITIONS

Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel and Brome Grass.

1.4 QUALITY ASSURANCE

A. Sod Installation: The contractor who installs the sod shall have a minimum of three years experience on commercial projects of similar size or larger.

B. Sod: Sod shall have sufficient root development to support its own weight without tearing when suspended vertically by holding the upper two corners, free of weeds and undesirable native grasses.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver sod on pallets or in rolls. Protect exposed roots from dehydration.

B. Do not deliver more sod than can be laid within twenty-four (24) hours.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis and name of manufacturer.

D. Store materials in accordance with manufacturer's recommendation and as directed by Owner's Representative.

1.6 COORDINATION

A. Coordinate the work of this section with installation of any underground piping, conduit or wiring.

B. Coordinate the work of this section with the planting installation.

1.7 WARRANTY / ACCEPTANCE

A. Complete installation shall be guaranteed by the installer against defects of material and workmanship, for a period of thirty days, beginning with the date of final completion.

B. It is the responsibility of the Contractor to establish a dense lawn of permanent grasses as specified.

C. All sodded areas shall have no bare spots or unacceptable areas. Unacceptable areas shall be resodded to meet original specifications.

1.8 MAINTENANCE SERVICE

A. Maintain installed sod, beginning with initial installation, until final acceptance. Maintenance shall include mowing, edging, watering, fertilizing and weed treatment as necessary to keep the sod healthy.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sod: ASPA approved, nursery grown, 'U3' Bermuda with strong fibrous root system capable of growth and development when planted; free of stones, or bare spots; containing no more than ten (10) weeds per one hundred (100) square feet.

B. Topsoil: As required for fine grading, provide imported topsoil per notes on Drawings.

C. Fertilizer: As specified on drawings.

D. Water: Utilize domestic water from Owner's property at no cost to the Contractor. Utilize site irrigation system for watering – see drawings for limits of new system.

2.2 HARVESTING SOD

A. Machine cut sod and load on pallets in accordance with ASPA guidelines.

B. Cut sod with minimum of one-half (1/2) inch and maximum one (1) inch topsoil base.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify with General Contractor that the site is ready for fine grading and sodding.

B. By beginning installation, the contractor accepts existing site conditions. Ensure that all construction work that may impact sodding work has been completed, including underground utilities, paving, walls, drainage piping, irrigation, etc.

3.2 PREPARATION

A. Contractor who is doing sodding work shall be responsible for finish grading to a smooth, even surface for all sodded areas.

B. Scarify subsoil where topsoil is required and where equipment used during construction has compacted topsoil.

C. Place topsoil and fine grade during dry weather.

D. Remove non-organic material prior to sodding, including gravel, construction debris, etc.

E. Grade to eliminate rough, low or soft areas, and to ensure positive drainage.

F. Top of finished grade to be 1" below adjacent paved surfaces.

G. Top of sod slab to be flush with top of paving

H. All lawn areas are to be graded to a smooth even surface free of bumps and depressions, with loose uniformly fine texture, to achieve grades shown on Drawings.

3.3 FERTILIZING

A. Apply fertilizer as indicated on plans.

B. Apply after smooth raking of topsoil and prior to installation of sod. Apply fertilizer no more than forty-eight (48) hours before laying sod.

C. Mix thoroughly into upper one (1) inch of topsoil.

D. Lightly water before installation to aid the dissipation of fertilizer.

3.4 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod. Lay sod within twenty-four (24) hours after harvesting to prevent deterioration.

B. Remove netting from back of sod.

C. Lay sod tight with no open joints visible and without overlapping removing all plastic netting; stagger end joints twelve (12) inches minimum. Do not stretch or overlap sod pieces.

D. Lay sod smooth. Place top sod elevation slightly below the edging or paving. Place sod flush with any existing lawn surface.

E. After sodding, roll with commercial lawn roller to ensure good bond between sod and soil and to remove minor depressions and irregularities.

F. Water sodded areas immediately after installation and rolling. Saturate soil to a depth of four inches.

G. All finished sodding shall be smooth and free of significant lumps or depressions. If sod settles or depressions result from watering or other activities, repair and re-roll as required. Top dress all open joints as directed to create a smooth finished lawn surface.

3.5 CLEAN-UP AND PROTECTION

A. Remove excess and waste material daily.

B. Erect warning signs, tape and barriers as necessary to protect sod against damage.

3.6 MAINTENANCE

A. Maintain lawn from initial installation through final acceptance as specified below.

B. Water to prevent grass and soil from drying out.

C. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

D. Immediately replace sod in areas which show deterioration or bare spots to establish a smooth acceptable lawn, free of eroded or bare areas.

E. Repair or replant areas that have been damaged or trampled.

F. Mow turf when grass reaches a height of 2". Mowing height to be 1 1/2".

G. Edge all walks, curbs, and other edges at each mowing.

END OF SECTION 32 9200

SECTION 33 4100 – STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes storm sewer piping and related components outside the building which are to be retained by the Owner as private improvements at the completion of the project.

1.3 RELATED SECTIONS

A. Section 32 1313: Concrete Paving.

1.4 REFERENCED STANDARDS

A. Latest version or edition shall apply unless otherwise noted.
   1. American Association of State Highway and Transportation Officials (AASHTO)
      a. M252, Standard Specification for Corrugated Polyethylene Drainage Pipe.
      b. M294, Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in) Diameter.
   2. American Concrete Institute (ACI)
      a. 318, Building Code Requirements for Structural Concrete and Commentary.
   3. American Concrete Pipe Association (ACPA)
      a. Concrete Pipe Installation Manual.
   4. American Society of Testing and Materials (ASTM)
      a. A48, Standard Specifications for Gray Iron Castings.
      b. C76, Standard Specifications for Reinforced Concrete Culvert, Storm Dain and Sewer Pipe.
      c. C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gasket.
      d. C890, Standard Practice for Minimum Structural Design Loading For Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
      e. C891, Standard Practice for Installation of Underground Precast Concrete Utility Structures.
      f. C913, Standard Specification for Precast Concrete Water and Wastewater Structures.
      g. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Lateral.
      h. C924, Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
      i. C990, Standard Specification for Joints for Concrete Pipe, Manholes and Precast Cox Sections Using Preformed Flexible Joint Sealants.
      j. C1173, Standard Specification for Flexible Transition Couplings for Underground Piping System.
      k. C1460, Standard Specification for Shielded Transition Couplings for Use with Dissimilar DWV Pipe and Fittings Above Ground.
      l. C1479, Standard Practice for Installation of Precast Concrete Sewer, Storm Drain and Culvert Pipe Using Standard Installations.
   5. PVC Pipe Association
      a. UNI-B-06, Recommended Low-Pressure Air Testing of Installed Sewer Pipe.

1.5 DEFINITIONS

A. ACI: American Concrete Institute.

B. AHJ: Authority Having Jurisdiction.
   1. City of Tulsa, Public Works Department
      a. Municipal permitting and work order requirements.

b. Inspections of constructed private storm sewer improvements as required to ensure compliance with adopted plumbing code.

C. ACPA: American Concrete Pipe Association.

D. Box Inlet: Square concrete structure with openings for collection of storm water at the top of one or more sidewalls. Inlet is typically provided with a concrete lid containing a standard manhole frame and lid.

E. CGMA: Corrugated Metal Pipe Arch.

F. CGMP: Corrugated Metal Pipe.

G. Combination Inlet: Storm water inlets which include both grates and curb hoods.

H. Crushed Rock Foundation: Aggregate layer placed beneath proposed storm sewer structures.

I. Grated Area Inlet: Storm water inlets which include grates only. When installed in paved areas, frame is typically cast into adjacent paving. When installed in non-paved areas, concrete apron is usually documented around perimeter of grate.

J. HDPE: High Density Polyethylene.

K. IPC: International Plumbing Code, version as adopted by AHJ.

L. Utility Owner:
1. City of Tulsa, Public Works Department.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product used in completion of the scope of work.

B. Shop Drawings: For all pre-cast or PVC structures used in the completion of the scope of work.
1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

1.7 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.8 DELIVERY, STORAGE AND HANDLING

A. Do not store plastic fittings in direct sunlight.

B. Protect pipe, pipe fittings and seals from dirt and damage.

C. Handle pre-cast storm sewer structures according to manufacturer's written rigging instructions.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirement indicated:
1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.
3. Do not proceed with interruption of service without Utility Owner's written permission.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Crushed Rock Foundation: Uniformly graded crusher run material without rounded faces. Gradation shall be as follows:
1. Sieve size: 2-in, percent passing 100%.
2. Sieve size: ½-in, percent passing less than 30%.

2.2 HDPE STORM SEWER AND FITTINGS (NPS 4 to NPS 18)

A. Dual Wall HDPE: Advance Drainage Systems (ADS) N-12 or approved equal. Pipe shall meet the requirements of ASTM F2648.

1. Joints: Per ASTM F477. Joints shall be per Construction Drawings and the following schedule:
   a. Water-tight (WT): Bell and spigot joint meeting the requirements of ASTM D3212.
2. Fittings: Per ASTM F2306. Joint type shall be equivalent to that of adjacent pipe(s).
3. Perforations: Where specified, perforations shall be provided per the requirements of AASHTO M252 for NPS 4 through NPS 10 and AASHTO M294 for NPS 12 through NPS 60.

2.3 HP STORM SEWER AND FITTINGS (NPS 18 to NPS 60)

A. High-Performance Polypropylene: Advance Drainage Systems (ADS) HP Storm or approved equal. Pipe shall meet the requirements of ASTM F2881 or AASHTO M330.
1. Joints: Per ASTM F477. Joints shall be per Construction Drawings and the following schedule:
   a. Water-tight (WT): Bell and spigot joint meeting the requirements of ASTM D3212.
2. Fittings: Per ASTM F2881 or AASHTO M330. Joint type shall be equivalent to that of adjacent pipe(s).

2.4 PVC PIPE AND FITTINGS

A. PVC Cellular-Core Piping:

1. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.

B. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F 477, elastomeric seals.

C. PVC Profile Sewer Piping:

1. Pipe: ASTM F 794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

D. Small Diameter Lines (NPS 3 to NPS 4):

1. Pipe: ASTM D 1785, Schedule 40, with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 2466, Schedule 40, socket type.

E. Medium Diameter Lines (NPS 4 to NPS 36):

1. Pipe and Fittings: ASTM D3034, SDR-35 or ASTM F 679, PS46, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.
2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.

F. PVC Pressure Piping:

1. Pipe: AWWA C900, Class 150 PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, Class 150 PVC pipe with bell ends
3. Gaskets: ASTM F 477, elastomeric seals.

2.5 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.

2.6 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end. Installation type and location shall meet IPC requirements.

B. Shielded, Flexible Couplings:
   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. Cascade Waterworks Mfg.
      b. Dallas Specialty & Mfg. Co.
      c. Fernco, Inc.
      d. Mission Rubber Company; a division of MCP Industries, Inc.

C. Sleeve Materials:

   1. For Concrete Pipes: ASTM C 443, rubber.
   2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   3. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   4. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   5. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.7 PRIVATE STORM SEWER STRUCTURES

A. Meeting construction Drawing requirements in regards to location, dimensions, depth, invert elevation(s), weir elevation(s), grate elevation, rim elevation and/or top of curb elevation. Material of construction shall be as indicated on the construction Drawings and shall generally be PVC, masonry, pre-cast concrete or cast-in-place concrete.

B. Material Substitutions: Subject to review and approval of the Engineer and the following schedule:
   1. Permitted substitutions:
      a. Pre-cast concrete for cast-in-place concrete.
   2. Prohibited substitutions:
      a. Masonry for pre-cast concrete or cast-in-place concrete.

C. Brick masonry structures:
   1. Brick: 2-1/4" x 7-5/8" x 3-5/8". Meeting the requirements of ASTM C55, Grade S-1.
   2. Mortar: ASTM C270, Type M.

D. Cast-in-place concrete structures:
   1. Concrete: Class A per Section 32 1313.
   2. Reinforcement: Of the size, length and configuration indicated on the Construction Drawings. Reinforcing steel shall be billet or axle steel per Section 32 1313.

E. Pre-cast structures: Pre-cast manhole structures shall meet the requirements of ASTM C478. All other pre-cast concrete structures shall meet the requirements of ASTM C913. All pre-cast structures shall be designed according to ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading.

   1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   2. Diameter: 48 inches minimum unless otherwise indicated.
   3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
   4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
   5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.

6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealants: ASTM C990, bitumen or butyl rubber.
8. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.
9. Steps: Wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inchintervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

F. Frames, Covers and Grates: ASTM A48, Class B, Grade U-60-60, designed for A-16 (AASHTO HS20-44) structural loading. Manufacturers and models shall be per the following schedule, substitutions subject to review and approval of the engineer:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.
3. Manhole Frame and Cover: Deeter Foundry, Product no. 1159.
4. Grated Area Inlet Frame and Grate:
   a. Gutter Inlet Frame: Neenah Foundry, Product No. 3076 (3-flange).
   b. Gutter Inlet Grate: Neenah Foundry, Type V.

2.8 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
   g. Or approved equal.
2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Heavy Duty.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

PART 3 - EXECUTION

3.1 EXCAVATION

A. All excavation, trenching and backfilling shall be completed as indicated on the Construction Drawings. Contractor is responsible for protecting items to remain for the duration of the project as well as adjacent, off-site features. The following additional standards shall also apply:
   1. Private Single and Dual Wall HDPE Installations: Per requirements of ASTM D2321 and pipe manufacturer requirements.

3.2 PRIVATE STORM SEWER PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves and couplings according to manufacturer's written instructions for use of lubricants, cements and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use trenchless methods as indicted on the Construction Drawings.

3.3 PRIVATE STORM STRUCTURE INSTALLATION

A. Brick Masonry Structures:
   1. Foundations: A prepared foundation shall be placed for all brick structures after the foundation excavation is completed and accepted. Unless otherwise specified, the base shall consist of Class A Concrete per Section 32 1313. The foundation shall be built to the correct elevation and shall be finished to ensure the least possible resistance of flow.
   2. Laying Bricks:
      a. All bricks shall be thoroughly clean. The bed which is to receive the brick shall be thoroughly cleaned and wetted with water before placing mortar thereon. All brick shall be laid in freshly made mortar composed of one part by volume of Portland Cement and three parts by volume of sand with the possible addition of hydrated lime in an amount not to exceed fifteen percent (15%) by volume of the cement used. The brick shall be laid in course using the shoved joint method to thoroughly bond them into the mortar and always with the joints completely filled with mortar. The brick shall be laid in a work person-like manner and true to the lines and grades indicated on the Plans. The arrangement of headers and stretchers shall be such as will thoroughly bond the masonry, and unless otherwise indicated, brick masonry shall be of alternate headers and stretchers with consecutive courses breaking joints. The courses shall be laid continuously with joints broken or alternating evenly with the joints in the proceeding courses. The joints shall not be less than one-fourth inch (1/4") more than one-half inch (1/2") in thickness. Face joints shall be neatly struck, using the weather joint. All joints shall be finished properly as the laying of brick progresses.
      b. No spalls or batts shall be used except in shaping around irregular openings or connections or when unavoidable to finish out a course, in which case, a full brick shall be used at the corner and the bat in the interior of the course.
      c. In case any brick is removed, or a joint broken during the laying, the brick shall be taken up, the mortar thoroughly cleaned from the brick, bed, joints and the brick relaid in fresh mortar. In hot and dry weather or when directed, the brick masonry shall be protected and kept moist for a period of at least forty-eight (48) hours after laying the brick.

d. Brick masonry shall not be constructed in freezing weather or when bricks contain frost, except by written permission of the Engineer and subject to such conditions for protection against freezing.

B. Cast-in-Place Concrete Structures: Complete construction per requirements of ACI 318.

C. Pre-Cast Structures: Install structure per requirements of ASTM C891.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 6 inches deep.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 CONNECTIONS

A. Connect non-pressure, gravity-flow drainage piping in building's storm building drains.

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing underground manholes and structures by cutting into existing unit and creating an opening large enough allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
   a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
   b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
3. Protect existing piping, manholes and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.6 IDENTIFICATION

A. Materials and their installation are specified in Section 31 2000 "Earth Moving". Arrange for installation of warning tape directly over piping and at outside edge of underground structures.
1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.7 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place and again at the completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder not less than 92.5 percent of piping diameter.

c. Damage: Crushed, broken, cracked or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.

4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems and parts of existing systems that have been altered, extended or repaired for leaks and defects.
1. Do not enclose, cover or put into service before inspection and approval.
2. Test completed piping systems according to requirements of Service Provider.
3. Schedule tests and inspections by Service Provider with at least 24 hours; advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirement of Service Provider, UNI-B-6, and the following:
a. Test concrete piping according to ASTM C924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.8 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 33 4100



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