

The Lower Colorado River Authority
3700 Lake Austin Blvd.
Austin, Texas 78703
LCRA Contract No: 4524

Lake Bastrop North Shore
Restroom Facility
May 16, 2019
GSC Architects



100% Construction Documents

LAKE BASTROP NORTH SHORE RESTROOM FACILITY

603 FM 1441
Bastrop, TX 78602

THE LOWER COLORADO RIVER AUTHORITY

3700 Lake Austin Blvd.
Austin, TX 78703


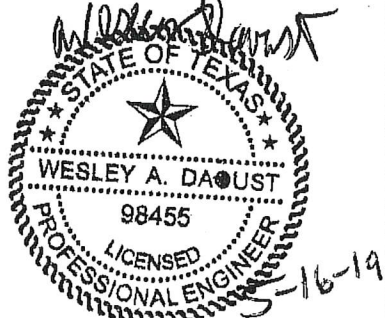
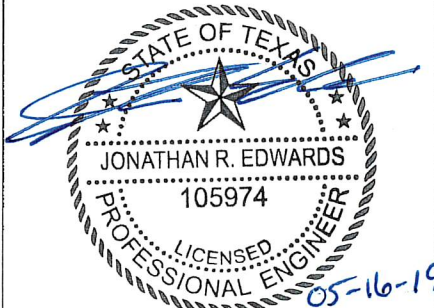
GSC Architects

3100 Alvin DeVane Blvd., Building A, Suite 200-B, Austin, TX 78741

GSC Architects Project No.: 201901300
LCRA Contract No.: 4524

The Lower Colorado River Authority
 3700 Lake Austin Blvd.
 Austin, Texas 78703
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Lake Bastrop North Shore
 Restroom Facility
 May 16, 2019
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Owner	Lower Colorado River Authority 3700 Lake Austin Blvd. Austin, Texas 78703	Professional Seal
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Structural Engineer	Jonathan Edwards, P.E. Dawson Van Orden, Inc. (DVO) 100 Commons Road, Suite 11 Dripping Springs, TX 78620 (281) 293-5700	

PROJECT TEAM

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THE LOWER COLORADO RIVER AUTHORITY

LAKE BASTROP NORTH SHORE RESTROOM FACILITY

603 FM 1441
Bastrop, TX 78602

100% Construction Documents (Unsealed)

April 29, 2019

GSC Project No. 201901300

Project Title: Lake Bastrop North Shore Restroom Facility
LCRA Project Manager, Harold Goodson, (512) 730-5248

Description of Work: Provide all labor, materials, tools, equipment and incidentals to demolish the existing restroom and build a new restroom using the existing foundation. Scope includes hazardous material abatement if needed and utilities, new construction of building exterior and interior and accessibility upgrades as needed.

Architect

GSC Architects
3100 Alvin DeVane Blvd.,
Building A, Suite 200-B,
Austin, TX 78741

Consultants:

MEP Engineer

Dawson Van Orden, Inc. (DVO)
100 Commons Road, Suite 11
Dripping Springs, TX 78620

Structural Engineer

Dawson Van Orden, Inc. (DVO)
100 Commons Road, Suite 11
Dripping Springs, TX 78620

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SECTION 01 00 05 - DEFINITIONS AND TERMINOLOGY

PART 1: GENERAL

1.01 SPECIFICATION TERMINOLOGY

- A. "Owner" means Lower Colorado River Authority, a conservation and reclamation district of the State of Texas, created by the Texas Legislature and existing under Article XVI, Section 59 of the Texas Constitution.
- B. "Owner's Project Manager" shall be designated in writing by Owner, who shall have responsibility of all aspects of the project.
- C. "Owner's Engineer" also "Engineer of Record" shall be designated in writing by Owner, who has responsibility throughout the project as identified in the Contract Documents and Specifications.
- D. "Owner Site Representative" shall be designated in writing by Owner, who shall have the responsibility for management of site activities and construction related matters.
- E. "Furnish" means to supply, deliver and unload materials and equipment at the project site ready to install.
- F. "Install" means the operations at the project site including unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, coating, protecting, cleaning, training and similar operations required to prepare the materials and equipment for use, verify conformance with Contract documents and prepare for acceptance and operation by the Owner.
- G. "Provide" means to furnish and install materials and equipment.
- H. "Perform" means to complete the operations necessary to comply with the Contract Documents.
- I. "Indicated" means graphic representations, notes, or schedules on drawings, or other requirements in Contract Documents. Words such as "shown", "noted", "scheduled", are used to help locate the reference. No limitation on the location is intended unless specifically noted.
- J. "Specified" means written representations in the bid documents, drawings or the technical specifications.

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- K. "Regulation" means laws, statues, ordinances, and lawful orders issued by authorities having jurisdiction, as well as, rules, conventions, and agreements within the construction industry that control performance of work, whether they are lawfully imposed by authorities having jurisdiction or not.
- L. "Installer" means an entity engaged by Contractor, either as an employee, subcontractor, or sub-subcontractor to install materials and/or equipment. Installers are to have successfully completed a minimum of five projects similar in size and scope to this project, have a minimum of five years of experience in the installation of similar materials and equipment, and comply with the requirements of the authority having jurisdiction.
- M. "Manufacturer" means an entity engaged by Contractor, as a subcontractor, or sub-subcontractor to furnish materials and/or equipment. Manufacturers are to have a minimum of five years experience in the manufacture of materials and equipment similar in size, capacity, and scope to the specified materials and equipment.
- N. "Project site" means the space available to perform the work, either exclusively or in conjunction with others performing construction at the project site.
- O. "Testing laboratory" means an independent entity engaged to perform specific inspections or tests, either at the project site or elsewhere, and to report and interpret the results of those inspections or tests.
- P. "Listed" means equipment is included in a list published by a nationally recognized laboratory which makes periodic inspection of production of such equipment and states that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.
- Q. "Labeled" means equipment that embodies a valid label symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc. and production is periodically inspected in accordance with nationally recognized standards or tests to determine safe use in a specified manner.
- R. "Certified" used in context with materials and equipment means the material and equipment has been tested and found by a nationally recognized testing laboratory to meet specification requirements, or nationally recognized standards if requirements are not specified, and is safe for use in the specified manner. Production of the equipment must be periodically inspected by a nationally recognized testing laboratory and the equipment must bear a label, tag, or other record of certification.

"Certified" used in context with labor performance or ability to install materials and equipment means that the abilities of the proposed installer have been tested by a

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representative of the specified testing agency authorized to issue certificates of competency and has met the prescribed standards for certification.

“Certified” used in context with test reports, payment requests or other statements of fact means that the statements made on the document are a true statement as attested to by the certifying entity.

1.02 SPECIFICATION SENTENCE STRUCTURE

- A. Specifications are written in modified brief style. Requirements apply to all work of the same kind, class, and type, even though the word “all” is not stated.
- B. Simple imperative sentence structure is used which places a verb as the first word in the sentence. It is understood that the words “furnish”, “install”, “provide”, or similar words including the meaning of the phrase “The Contractor shall...” before these words.
- C. It is understood that the words “directed”, “designated”, “requested”, “authorized”, “approved”, “selected”, or similar words include the meaning of the phrase “by the Owner” after these words unless otherwise stated. Use of these words does not extend the Owner’s or Owner’s Engineer’s responsibility for construction supervision or responsibilities beyond those defined in the General Conditions.
- D. “At no additional cost to Owner”, “With no extra compensation to Contractor”, “At Contractor’s own expense”, or similar words mean that the Contractor will perform or provide specified operation of work without any increase in the Contract Amount. It is understood that the cost for performing all work is included in the amount bid and will be performed at no additional cost to the Owner unless specifically stated otherwise.

1.03 DOCUMENT ORGANIZATION

- A. The contract requirements described in the General Conditions, Supplemental General Conditions and Division 1 apply to each and all specification sections unless specifically noted otherwise.
- B. Organization of Contract Documents is not intended to control or to lessen the responsibility of the Contractor when dividing work among subcontractors, or to establish the extent of work to be performed by any trade, subcontractor or vendor. Specification or details do not need to be indicated or specified in each specification or drawing. Items shown in the contract documents are applicable regardless of location in the Contract Documents.

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- C. Standard paragraph titles and other identifications of subject matter in the specifications are intended to aid in locating and recognizing various requirements of the specifications. Titles do not define, limit, or otherwise restrict specification text.
- D. Capitalizing words in the text does not mean that these words convey special or unique meanings or have precedence over other parts of the Contract Documents. Specification text governs over titling and it is understood that the specification is to be interpreted as a whole.
- E. Drawings and specifications do not indicate or describe all the work required to complete the project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Owner's Site Representative. Provide any work, materials or equipment required for a complete and functional system even if they are not detailed or specified.

1.04 INTERPRETATIONS OF DOCUMENTS

- A. Comply with the most stringent requirements where compliance with two (2) or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, unless Contract Documents indicate otherwise.
 - 1. Quantity or quality level shown or indicated shall be minimum to be provided or performed in every instance.
 - 2. Actual installation must comply exactly with minimum quality indicated, or it may exceed that minimum within reasonable limits.
 - 3. In complying with these requirements, indicated numeric values are minimum or maximum values, as noted, or appropriate for context of requirements.
 - 4. Refer instances of uncertainty to the owner's Resident Representative to clarify the uncertainty before proceeding.
- B. Provide materials and equipment comparable in quality to similar materials and equipment incorporated in the project or as required to meet the minimum requirements of the application if the materials and equipment are shown in the drawing but are not included in the specifications.

1.05 REFERENCE STANDARDS

- A. Comply with applicable construction industry standards as if bound or copied directly into the Contract Documents regardless of lack of reference in the Contract Documents.

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Apply provisions of the Contract Documents where Contract Documents include more stringent requirements than the referenced standards.

1. Standards referenced directly in the Contract Documents take precedence over standards that are not referenced but recognized in the construction industry and engineering profession as applicable.
 2. Comply with standards not referenced but recognized in the construction industry as applicable for performance of the work except as otherwise limited by the Contract Documents. The Owner's Engineer determines whether code or standard is applicable, or which of several are applicable.
- B. Consider a referenced standard to be the latest edition with supplements or amendments when a standard is referred to in an individual specification section but is not listed by title and date.
- C. Trade association names and title of general standards are frequently abbreviated. Acronyms or abbreviations used in the Contract Documents mean the recognized name of trade association, standards generating organization, authority having jurisdiction, or other entity applicable in the context of the Contract Documents. Refer to "Encyclopedia of Associations", published by Gale Research Company.
- D. Make copies of reference standards available as requested by Owner's Resident Representative.

1.06 SUBSTITUTIONS AND EQUAL PRODUCTS

Provide materials and equipment manufactures by the entities specifically listed in each technical specification section. Submit a Contractor's Modification Request per Section 01300, SUBMITTALS for substitution of materials and equipment of manufacturers not specifically listed or for materials and equipment that does not strictly comply with the Contract Documents.

END OF SECTION

SECTION 01 01 00 - SUMMARY OF WORK

PART 1: GENERAL

1.01 WORK INCLUDED

- A. Construct work as described in the Contract Documents.
 - 1. Provide the materials, equipment, and incidentals required to make the project completely operable.
 - 2. Provide the labor, equipment, tools, and consumable supplies required for a complete project.
 - 3. Provide the civil, structural, mechanical, and all other work required for a complete and operable project.
 - 4. Test and place the completed project in operation.
 - 5. Correct non-conforming work within the *one-year* warranty period.
 - 6. Drawings and specifications do not indicate or describe all of the work required to complete the project. Additional details required for the installation, means and methods are to be provided by the Contractor and coordinated with the Owner's Representative.

1.02 JOB CONDITIONS

- A. The General Conditions, the Supplementary General Conditions, and Division One specifications apply to each specification section.
- B. Comply with all applicable state and local codes and regulations pertaining to the nature and character of the work being performed.

1.03 DESCRIPTION OF WORK

- A. Lake Bastrop North Shore is located in Bastrop, Texas, in Bastrop County. The construction entrance and staging areas can be accessed from the Park Entrance Road. A location map is included in the drawings.
- B. Work is described in general, non-inclusive terms as:
 - 1. Demolition of the existing restroom facility. Demolition does not include removal of the concrete foundation.

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2. The Work consists of the construction of concrete masonry units, stone veneer, structural steel, steel deck, insulated metal wall panels, formed concrete, fixed open louvers, insulation, standing seam metal roofing, sheet metal flashing and trim, joint sealant work, hollow metal doors and frames, door hardware, mirrors, interior and exterior painting, metal signage, phenolic toilet compartments, fire extinguishers and cabinets, toilet accessories, mechanical systems, plumbing systems and electrical systems and other Work indicated in the Contract Documents.

1.04 WORK BY OWNER NOT INCLUDED IN THIS CONTRACT

- A. Completion of the work described in this contract may impact the Construction and testing of the items listed above.
 - 1. Coordinate construction activities through the Owner's Representative.
 - 2. Pay claims for damages which result from the late completion of the project or any specified milestones.
- B. Owner will perform work as required for the operation and maintenance of the existing facilities during construction, unless otherwise stated.

1.05 WORK BY OWNER FOR THIS CONTRACT

- A. Owner will provide the following for this project:
 - 1. Provision of on-site resident representative to serve as Owner's Representative during construction.
 - 2. Provision of quality assurance testing for Owner. Owner's laboratory will not be available for use by Contractor in conducting Contractor's quality control testing.
 - 3. Designation of environmentally sensitive areas.
 - 4. Spill Prevention, Control and Countermeasure Plan.
 - 5. Stormwater Pollution Prevention Plan.
 - 6. River control plan.
 - 7. NPDES permit application, jointly with Contractor.

1.05 OCCUPANCY

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- A. Testing of equipment and appurtenances including specified test procedures, training, and start-up does not constitute acceptance for operation.
- B. Owner may accept completed work after testing at the option of the Owner.
- C. The execution of bonds is understood to indicate the consent of the surety.
- D. Conduct operations to insure the least inconvenience to the Owner and general public.

1.06 CONTRACTOR'S USE OF PROJECT SITE

- A. Limit the use of project site for work and storage to the areas at the site designated on the drawings.
- B. Contractor shall not be permitted access to restricted areas or areas outside the limits of construction.
- C. Coordinate the use of the premises with the Owner's Representative.
- D. Assume full responsibility for the protection and safekeeping of products stored at the site or staging and laydown area.
- E. Store products to allow owner access for maintenance and operations.
- F. Obtain and pay for the use of any additional storage or work areas needed for construction.
- G. Any damage to existing facilities or the staging area, including contamination, caused by the Contractor's personnel, visitors, materials, or equipment, shall be repaired or corrected at the Contractor's expense.
- H. No alcoholic beverages, tobacco products or illegal substances shall be permitted on the site at any time.
- I. No weapons shall be permitted on the site at any time.
- J. The powerhouse shall be off-limits for access by the Contractor's personnel and equipment. No equipment or materials shall be stored in the powerhouse.
- K. Limit the temporary placement of materials and equipment atop the powerhouse intake section. Work area shall be cleaned and maintained daily. Passageways to stairs, ladders, equipment, and intake superstructure shall be kept clear at all time to allow Owner full access.

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END OF SECTION

SECTION 01 01 40 - ENVIRONMENTAL PROTECTION

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. Construction of the Work covered by these Contract Documents is subject to the applicable provisions and rules of the Texas Commission on Environmental Quality (TCEQ) and United States Army Corps of Engineers and all other local applicable Federal, State, and Local laws, rules, regulations, ordinances, and conditions/requirements of permits issued by governmental agencies for the conduct of this project.

1.02 RELATED SECTIONS

- A. 01300 – Submittals
- B. 02105 – Containment and Disposal of Waste

1.03 SUBMITTALS

- A. Record Data - Storage and Fueling Plan: for hydraulic fluid, oil, and fuel: Submit for approval by ENGINEER prior to bringing fuel storage on-site. Describe plan for fueling equipment and fuel storage including spill prevention, containment, and cleanup provisions. Provide a list of all equipment that will contain more than 55 gallons of hydraulic fluid, oil, or fuel. Provide drawings for the secondary containment systems pertaining to above ground fuel storage tanks, equipment-mounted fuel tanks, oil reservoirs, and oil and fuel lines (including hydraulic fluid lines). Provide a description on how secondary containment will be inspected. Provide a description on how fueling operations will be handled over or near a waterway, or on shore, describing environmental protection methods that will be implemented. Provide description for requesting additional fuel storage containers not included in initial request. Provide inspection form to be used on a weekly basis in evaluating these areas.
- B. Record Data - Equipment Maintenance Plan: Describe plan for minimizing the potential environmental impacts of preventative and non-scheduled equipment maintenance activities. Describe what environmental protections measures will be implemented prior to and during both preventative and non-scheduled equipment maintenance activities.
- C. Record Data – Equipment Inspection Reports: Provide inspection procedure and example inspection form to be used on a weekly basis to report equipment inspections.
- D. Record Data – MSDS: Provide MSDS data sheets on all proposed fuels, chemicals, paints, greases, hydraulic fluids, coatings, epoxies, cements, admixtures, etc. to be used on and with equipment, to be used temporarily during construction, and to be permanently incorporated into the work.
- E. Record Data – Materials used to perform the Work: Provide a list for the following types of materials that will be used in performing the Work.

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1. Ozone-depleted chemicals
2. Materials with volatile organic compounds (VOC's)
3. Any material that will become an F-Listed waste (e.g. acetone, xylene, toluene, methyl ethyl ketone).
4. Acutely toxic materials.
5. Constituents subject to reporting under the state and federal Right-to-Know regulations (as shown on the Material Data Sheets).

- G. Record Data – Care of Water Plan: Describe plan for dewatering an area and managing water flows and infiltration into the work area. All water flows from, or generated by the work, must meet State and Federal regulations prior to entering a creek, stream or a lake. Regulations include, but not limited, to 30 TAC 307 and 26 TWC 121, Surface Water Quality Standards and Water Quality Control for the State of Texas respectively.

1.04 PROTECTION OF LAND RESOURCES

- A. The land resources, within the project boundaries and outside the limits of work under the Work of this Contract, shall be preserved in their present condition or be restored to a condition after construction that will appear to be natural and not detract from the appearance of the project. Activities shall be confined to areas defined by the Drawings and Specifications.

1.05 PROTECTION OF WATER RESOURCES

- A. No water courses shall be polluted with any construction debris, loose soil, suspended sediment, petroleum products, abrasives, epoxies, paints, solvents, cleaners, fuels, surface preparation materials, oils, lubricants, bitumen, calcium chlorides, insecticides, herbicides, or other toxic materials harmful to life unless specifically permitted. Chemical emulsifiers, dispersant, coagulants, or other cleanup compounds shall not be used without prior written approval. It is the responsibility of the CONTRACTOR to insure compliance with state and local water quality standards and to identify if any additional discharge permits are required to perform Work.

1.06 DEWATERING

- A. The CONTRACTOR will control and manage all dewatering of the project, and any non-storm water discharges from the construction site in compliance with all TCEQ water quality discharge requirements, including but not limited to 30 TAC 307, Surface Water Quality Standards for the State of Texas.
- B. Contractor shall provide continuous observation of dewatering activities and effectiveness of BMP's.
- C. The following non-storm water discharges from construction activities are acceptable.
1. Discharges from firefighting activities
 2. Fire hydrant flushings
 3. Vehicle, external building, and pavement wash water where detergents and soaps are not used and where spills or leaks of toxic or hazardous materials

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have not occurred (unless spilled materials have been removed; and if local, state, or federal regulations are applicable, the materials are removed according to those regulations), and where the purpose is to remove mud, dirt, and dust

4. Water used to control dust
5. Potable water sources including waterline flushings
6. Air conditioning condensate
7. Uncontaminated ground water or spring water, including foundation or footing drains where flows are not contaminated with industrial materials such as solvents or other pollutants

- D. Dewatering of water contaminated with hydrocarbons or other oils is prohibited from being discharged to a creek, stream, lake, or the soil surface.

1.07 PROTECTION OF AIR QUALITY

- A. All Work shall be performed in such a manner as to ensure that air quality is protected. CONTRACTOR will complete and maintain all records to support compliance with the applicable air quality standards including but not limited to 30 TAC 106.

1.08 PROTECTION OF FISH AND WILDLIFE

- A. All Work shall be performed and all steps taken to prevent interference or disturbance to fish and wildlife. Water courses or habitats outside the project boundaries shall not be altered or disturbed, without OWNER's written prior consent.
- B. This project is located in the Utilities Houston Toad permit area. The Houston toad is a federally-listed endangered species. The breeding season for the Houston toad is January 1 through June 30.
1. Construction shall occur outside the breeding season for the Houston toad.
 2. If mowing equipment is needed for clearing grass, forbs and small-diameter woody vegetation the blades must be set at a height of at least 5 inches above the ground to minimize the potential for striking toads.
 3. All disturbed areas shall be returned to approximate pre-construction contours where possible.
 4. Large disturbed areas shall be seeded with native, non-sod-forming species. Southeast Recovery Mix from Native American Seed shall be used if revegetation efforts are required.
 5. Imported topsoil shall be used only in areas disturbed to the point that the use of topsoil local to the site is not practical. Imported topsoil will be inspected for evidence of fire ants. Any imported topsoil found to contain fire ants or their eggs shall be treated prior to use.
 6. Gasoline and diesel fueled equipment shall be inspected for signs of fuel or hydraulic leak.
 7. All hazardous materials related to construction activities shall be properly contained, used and /or disposed of properly.

1.09 BURNING OF DEBRIS

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- A. No debris or surplus materials may be disposed of by burning at the job site or at any other location.

1.10 INFORMATION REGARDING WASTES REQUIRED WITH BID

- A. Waste control measures shall be implemented during construction activities to prevent unauthorized release and ensure proper management of waste in accordance with Section 02105 – Containment and Disposal of Waste.

1.11 PROHIBITED MATERIALS

- A. The CONTRACTOR is strictly prohibited from using any of the following types of materials that could generate waste in performance of the work.
 - 1. Asbestos, asbestos-containing material (ACM)
 - 2. Mercury containing material
 - 3. Surface coatings with lead, cadmium, chromium, or mercury
 - 4. PCB containing material
 - 5. Radioactive containing material

1.12 ENVIRONMENTAL INSPECTIONS

- A. The OWNER reserves the right to perform environmental inspections. The CONTRACTOR shall provide remedial action as required by the OWNER.

PART 2: PRODUCTS

2.01 ENVIRONMENTAL CONTROL DEVICES – NOT APPLICABLE

PART 3: EXECUTION

3.01 EROSION CONTROL DURING CONSTRUCTION

- A. The CONTRACTOR shall utilize the Best Management Practices (BMP's) with regard to controlling erodible soils within the construction lay-down area, project site, and while working near water. This may include installing and maintaining silt or additional controls as needed for any erodible soil, or storage of materials within the lay-down area and work site.

3.02 STORM WATER POLLUTION PREVENTION PLAN SWPPP – NOT APPLICABLE

3.03 ENVIRONMENTAL COMPLIANCE REQUIREMENTS

- A. The Work under this Contract is applicable to the requirements of 30 TAC Chapter 307, General Criteria for Texas Surface Water Quality Standards.
- B. The Work under this Contract is applicable to the requirements of Texas Administrative Code (TAC) [[http://info.sos.state.tx.us/pls/pub/readtac\\$ext.ViewTAC](http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC)]; Title 30

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Environmental Quality; Part 1 Texas Commission on Environmental Quality; Chapter 106 Permits By Rule:

1. Subchapter A General Requirements; Rule 106.4 Requirements for Permitting By Rule.
 2. Subchapter I Manufacturing; Rule 106.227 Soldering, Brazing, Welding,
 3. Subchapter K General; Rule 106.263 Routine Maintenance, Start-up and Shutdown of Facilities, and Temporary Maintenance Facilities; Paragraph (c) (3) (A); Paragraph (e) (7); Paragraph (f); and Paragraph (g).
 4. Subchapter T Surface Preparation 106.452 Dry Abrasive Cleaning.
- C. The Work under this Contract is applicable to the requirements of the LCRA Board Policies 507 - Water Quality Leadership and 402 - Environmental Leadership.
- D. The CONTRACTOR is responsible for following all state, local, and federal regulations. The above list was reviewed for applicability however; this may not be all encompassing. It is the responsibility of the CONTRACTOR to evaluate, determine applicability, and insure compliance with federal, state and local regulatory standards and obtain any additional permits or standards that apply to the Work being performed.
- E. The CONTRACTOR's means, methods, and duration of construction may require the following environmental compliance requirements for the project.
1. See section 1.08 Protection of Fish and Wildlife.

3.04 PLACEMENT AND MAINTENANCE OF ENVIRONMENTAL BOOMS – NOT APPLICABLE

3.05 PLACEMENT OF TEMPORARY PLATFORMS AND ACCESS FACILITIES – NOT APPLICABLE

3.06 PREVENTIVE MAINTENANCE, FUELING, AND SPILL CONTAINMENT

- A. Scheduled preventive maintenance shall be performed on all construction equipment prior to mobilization in the work area. CONTRACTOR shall establish a maintenance area within the staging area for performing all routine and preventative maintenance, when possible. CONTRACTOR shall thoroughly inspect all construction equipment for any leaks prior to use at the job site and on a daily basis.
- B. A spill can be defined as an accidental release of a solid, liquid, or gas to land, air, or water that would create a potential or actual hazard to human health or the environment.
1. The CONTRACTOR is solely responsible for any spills or release caused by himself or any of his subcontractors that occur during the performance of, or in connection with the performance of the Work under this Contract. The CONTRACTOR shall be responsible for all notifications required by any federal, state, or local law or regulations. The CONTRACTOR shall immediately notify the Project Manager or the LCRA Environmental Representative of the nature and location of any spill. The CONTRACTOR

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shall provide a written report to OWNER that identifies the substance, quantity released, location of the spill, agencies notified/talked to if any, cleanup and remediation activities conducted or planned. The written report should be a narrative that summarizes on the scene activity, remediation efforts, and if long term remediation will be required. This initial report shall be provided to the OWNER within 24 hours after the incident. Follow up reports may be required if requested by the OWNER. These requirements are also required if the spill occurs off the OWNER's property as a result of contractors performance of the Work under this Contract.

2. The CONTRACTOR shall be liable for, and agrees to indemnify and hold the OWNER harmless from any and all liabilities, including, but not limited to, remediation costs, fines, penalties, court costs, and attorney fees resulting from spills, releases, improper handling and/or disposal of wastes connected with a spill by the CONTRACTOR.
3. Spills shall be cleaned up to background levels or to criteria as set forth in the applicable federal, state, or local laws and regulations, or whichever is the most stringent.

C. The CONTRACTOR shall provide a temporary secondary containment berm with plastic liner around all stationary construction equipment subject to potential leakage of fluids or fuel to contain accidental leakage and/or discharges. Detection and cleanup of liquid fuel, oil leaks, or spills, shall be accomplished as follows.

1. Leak Detection: Leaks from any tanks or lines on equipment shall be detected by the CONTRACTOR during a daily check. Any fuel, oil, or chemical leak shall be reported immediately verbally and then in writing, in the appropriate format, to the OWNER's Resident Representative. The CONTRACTOR shall ensure that the source of the leak is repaired and that the spilled fluid is cleaned up immediately and thoroughly.
2. Leak Cleanup: The CONTRACTOR shall be responsible for all spill cleanups and notify OWNER's Resident Representative immediately. Any fuel, oil, or chemical leakage shall be collected in the bermed area surrounding the equipment using absorbent material. Contractor shall keep absorbent materials on site for clean up. Contaminated absorbent materials shall be disposed of in accordance with Section 02105 – Containment and Disposal of Waste.
3. Oil Filters: Used oil, oil filters, and cartridges shall be collected by the CONTRACTOR and these items will be recycled at an OWNER approved and audited recycling facility.
4. Operation of Equipment in Areas Subject to Direct Discharge to Waterways: Special precautions shall be taken to prevent releases of fuel, oil or chemicals when equipment is working over or adjacent to the water. This shall include provision of secondary containment for equipment-mounted fuel tanks, oil reservoirs, and fuel and oil lines (including hydraulic fluid lines). Exposed hydraulic lines shall be double wrapped and/or shielded by the use of deflectors, as necessary, to prevent a release to the water in the event of a line rupture. No fuel container larger than 250 gallons shall be stored on-site outside of the staging area designated on the construction drawings, unless prior written approval by the owner. Fueling of equipment over or adjacent to

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water shall be done using a maximum fuel storage/transfer container size of five (5) gallons. A funnel shall be used to minimize fuel spillage, and a drip pan shall be used to capture any spillage of fuel. If the total quantity of containers smaller than five gallons on a barge, platform, walkway, or structure exceeds five (5) gallons, then these multiple items shall be kept in secondary containment while in storage.

- D. The CONTRACTOR should attempt to use and work with the least amount of chemicals or fuels needed for a given job.

3.07 NOISE CONTROL

- A. The CONTRACTOR shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours. All construction machinery and vehicles shall be equipped with appropriate sound muffling devices and operated in a manner to cause the least noise consistent with efficient performance of the Work.

3.08 EQUIPMENT HYDRAULIC SYSTEMS

- A. All hydraulic systems and lines on CONTRACTOR's equipment should be evaluated to determine if vegetable-based or environmental friendly hydraulic oil can be utilized over waterways. Vegetable-based or environmental friendly hydraulic oil is required if equipment manufacturer allows replacement of standard hydraulic oils. Provide MSDS sheets on the proposed hydraulic fluids. All hydraulic systems shall be double wrapped with absorbent materials or use defluctive devises.

PART 4: MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Separate measurement or payment will not be made for Work required under this Section. All costs in connection with the Work specified herein will be considered to be included with the related item of Work in the Bid Schedule, or incidental to the Project.

END OF SECTION

SECTION 01 01 50 - CONTRACTOR USE OF THE PREMISES

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall not begin construction until all erosion and sedimentation control devices shown on the plans and related to the portion of the work have been installed, a preconstruction meeting at the site has been held per the plans, and the inspector has approved the erosion and sedimentation controls.
- B. Prior to construction, CONTRACTOR shall submit a plan, for approval, for staging and storage of materials and equipment. No staging and storage areas have been provided by the OWNER. If area is required, CONTRACTOR shall arrange and pay for such at no additional cost to the OWNER. Spoil material to be used on the job shall be stored within the limits of construction shown on the Plans. Trash, material unsuitable for fill and spoil material shall be permanently disposed of offsite. The CONTRACTOR shall take care not to cause mud, dirt and dust to be carried off the site. When construction is complete the site shall be fully restored and cleaned up of all trash, debris and contaminated soils due to chemical spills or other similar products. No burning on-site is permitted.
- C. All workers employed by the CONTRACTOR shall have such skill and experience as will enable them to properly perform the duties assigned them. Any person employed by the CONTRACTOR or a subcontractor who, in the opinion of the OWNER'S REPRESENTATIVE, does not perform his work in a proper and skillful manner, or who is disrespectful, intemperate, disorderly, or otherwise objectionable, shall at the written request of the OWNER'S REPRESENTATIVE be forthwith discharged and shall not be employed again on any portion of the work without the written consent of the OWNER'S REPRESENTATIVE. The CONTRACTOR shall furnish such suitable machinery, equipment, and construction forces as may be necessary, in the opinion of the OWNER'S REPRESENTATIVE, for the proper prosecution of the work, and failure to do so may cause the OWNER'S REPRESENTATIVE to withhold all estimates which have or may become due or the OWNER may suspend the work until his requests are complied with.
- D. All work within temporary or permanent easements shall conform to any and all restrictions, conditions, and/or requirements as may be set forth in the related specific easement documents. Easements secured for this project are shown on the plans and will be presented to the CONTRACTOR.
- E. All work within staging and storage areas obtained by CONTRACTOR shall conform to all requirements of these specifications.

1.02 NOTIFICATION OF PROPERTY OWNERS

- A. Unless otherwise indicated, the CONTRACTOR will notify property owners abutting the right-of-way or easements, or otherwise that will be affected by construction activities, of impending construction. The CONTRACTOR shall exercise diplomacy and tact with individual property owners. The CONTRACTOR shall specifically designate a single

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responsible individual that will be responsible for the giving of notifications to the affected property owners or tenants in accordance with this section. The OWNER will have the right to approve the responsible individual and may ask that they be replaced at anytime.

- B. CONTRACTOR shall give to property owners or tenants 48 hours notice prior to initiating work in their vicinity (within one city block or otherwise which might be affected by the work. Such notice shall be at a minimum presented by door hangers, the language on which shall be previously approved by the OWNER. The notice shall include a general description of the work to be accomplished, a direct contact name and local phone number for either the CONTRACTOR's superintendent or the employee responsible for the giving of notices, the name and phone number of the OWNER's onsite inspector, a general and accurate schedule identifying the time anticipated for the work and any other information pertinent to the work. Once notices are given, CONTRACTOR shall focus on completing that phase of work within the duration given. Subsequent notices may be required, at the sole discretion and direction of the OWNER, should the CONTRACTOR fail to complete the work within the identified schedule.
- C. Additional 48 hours notices shall be provided to property owners, or others that may be affected by the work, at the sole discretion and direction of the OWNER, for subsequent work activities or phases in the same area that occur beyond 10 working days of completing a work phase identified in an initial notice.

1.03 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

- A. Contractor shall protect, shore, brace, support and maintain all underground pipes, conduits, drains, and other underground facilities uncovered or otherwise affected by the Contractor's operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, sod, landscaping, irrigation, and other surface structures affected by construction operations shall be restored to their original condition, whether within or outside the easement/right-of-way. All replacements shall be made with new materials of equal appearance.
- B. Only trees marked on the plan to be removed may be removed. All other trees shall be protected against injury from construction operations. Tree protection shall be installed at locations as indicated on the plans. Whenever practicable, the Contractor shall utilize hand excavations to tunnel underneath large tree roots.
- C. Dust Control during construction shall be performed by the Contractor in a manner to minimize nuisance conditions and to the satisfaction of the Owner's Representative. The Contractor shall provide a dust control system for trenching operations. No direct payment will be made for dust control.
- D. On a daily basis the Contractor shall sweep all streets, driveways and parking areas on which trenching, excavating, pipe laying or other dust generating activities occur. A street sweeper containing a dust control system shall be maintained on the project site at all times that trenching, excavating, pipe laying or other dust generating activities are ongoing.
- E. Hand excavate to tunnel under other underground obstructions.

1.04 TEMPORARY DRAINAGE PROVISIONS

- A. Contractor shall be responsible for providing for the drainage of stormwater and such water as may be applied or discharged on the site in performance of the Work. Contractor shall construct temporary drainage facilities to handle, carry through, or divert around his Work all drainage flow, including storm flows to prevent silting of waterways or flooding damage to adjacent properties.

1.05 NOISE CONTROL

- A. Contractor shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound level in the area during working hours. All construction machinery and vehicles shall be equipped with practical sound-muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the Work.

1.06 PROJECT SIGN

- A. Contractor shall furnish, fabricate and erect moveable project signs. The signs shall be per the details shown on the plans. The text on the signs shall be painted on the signs with exterior oil-based paint. The Owner shall supply the Contractor with a template for the LCRA logo. Color of the background and lettering shall be selected by the Owner. The signs shall be located in the proximity of the work areas and moved as construction progresses. It shall be the responsibility of the Contractor to maintain and relocate the signs. Care shall be taken to ensure that placement of the signs does not interfere with or cause sight obstruction to vehicular or pedestrian traffic. No separate payment shall be made for furnishing, fabricating, erecting, or maintaining the project signs; include cost in the cost for mobilization.

1.07 WORK ON COMMERCIAL PROPERTIES

- A. The CONTRACTOR shall maintain driveway access to all commercial properties during construction of mains and services. Work shall be phased to have a minimal impact on parking during construction. The CONTRACTOR shall coordinate with the property representative regarding the timing of parking space closures and timing of deliveries to the properties.

1.08 MAINTENANCE OF TRAFFIC

- A. Contractor shall conduct his Work to have the least impact with vehicular and pedestrian traffic as is practicable. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether private or public, the Contractor shall provide and maintain suitable traffic control devices, detours, or other temporary measures to accommodate travel, and shall provide reasonable notice to owners of private drives prior to interfering with them.
- B. Safety and conveyance of traffic shall be regarded with prime importance. Unless otherwise directed, all portions of streets associated with this Project shall be kept open

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and provided a dust free, smooth and comfortable ride to traffic. In making open cut street/driveway crossings, the Contractor shall not block more than one-half of the street/driveway at one time without approval of the Owner.

- C. Prior to beginning Work, Contractor shall designate to the Owner a competent person who will be responsible and available to ensure compliance with the traffic control plans.
- D. The Contractor shall perform the necessary cleanup and temporary or final finishing immediately at the end of each day to fully reopen all streets and driveways. Temporary surfacing shall be provided where necessary to provide a smooth and safe ride in public streets and driveways.
- E. Where indicated on the traffic control plan, Contractor shall erect and maintain detours around construction activities.
- F. All traffic control devices shall be constructed and placed in accordance with the Texas Manual on Uniform Traffic Control Devices and the traffic control plans for the project. The Contractor shall be solely responsible for their placement and maintenance throughout the project.
- G. All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions, such as material piles and equipment shall be provided with similar warning signs and lights, and shall be illuminated with warning lights from sunset to sunrise.

PART 2: NOT USED

PART 3: NOT USED

PART 4: MEASUREMENT AND PAYMENT

- A. No separate payment shall be made for work described in this section.

END OF SECTION

SECTION 01 03 00 - SPECIAL PROCEDURES

PART 1: GENERAL

1.01 CONSTRUCTION SEQUENCE

- A. Perform the work as required to complete the entire project within the contract time.
- B. Perform the work not specifically described in the Section as required to complete the entire project within the contract time.

1.02 SHUT DOWNS AND PLANS OF ACTION

- A. Shut-downs of operations or equipment must be planned and scheduled with the Owner.
 - 1. Submit a written plan of action for approval for shutting down essential services.
 - 2. Describe the following in the Plan of Action:
 - a. Construction necessary
 - b. Key personnel and method of communication with key personnel
 - c. Utilities, piping or services affected
 - d. Length of time the service or utility will be disturbed
 - e. Procedures to be used to carry out the work
 - f. Plan of Action to handle emergencies, including notification and response.
 - g. Contingency plan that will be used if the original schedule cannot be met
 - 3. Plan must be received and approved by the Owner forty-eight (48) hours prior to beginning the work.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with 01300 – SUBMITTALS.

END OF SECTION

SECTION 01 04 00 - PROJECT ADMINISTRATION

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Administer contract requirements to construct the project. Provide documentation per the requirements of this Section. Provide information as requested by the Engineer, Owner, or Owner's Representative concerning this project.

1.02 SUBMITTALS

- A. Submittals shall be in accordance with Section 01300 – SUBMITTALS.

1.03 COMMUNICATION DURING THE PROJECT

- A. The Owner's Representative is to be the first point of contact for all parties on matters concerning this project.
- B. The Owner's Representative will coordinate correspondence concerning:
 - 1. Submittals, including requests for payment
 - 2. Clarification and interpretation of the Contract Documents
 - 3. Contract modifications
 - 4. Observation of work and testing
 - 5. Claims
 - 6. Operations and logistical matters
- C. The Owner's Representative will normally communicate only with the Contractor's designated representative. Any required communication with suppliers or subcontractors will only be with the direct involvement of the Contractor.
- D. Written communications are to be directed to the Owner's Representative at the address indicated in the Pre-construction Conference. Communications should include as a minimum:
 - 1. Reference Number
 - 2. Name of the Owner
 - 3. Project Name
 - 4. Date
 - 5. A Reference Statement
- E. Submit communications on the forms referenced in this Section, Section 00860 – FIELD COMMUNICATION PLAN AND FORMS, or in Section 01300 – SUBMITTALS.

1.04 PROJECT MEETINGS

A. Pre-Construction Conference

1. Attend a pre-construction meeting
2. The location of the conference will be determined by the Owner. The meeting will discuss in detail all the communication, documentation and forms, and points of communication of the Contractor with the Owner and the Owner's Engineer of Record.
3. The time of the meeting will be determined by the Owner's Representative but will be after the Notice of Award is issued and not later than fifteen (15) days after the Notice to Proceed is issued.
4. Meeting may be attended by the Owner, Engineer, Owner's Representative, the Contractor's project manager and superintendent, and representatives from major subcontractors and suppliers.
5. Contractor shall provide and be prepared to discuss:
 - a. Preliminary construction schedule per Section 01310 – PROGRESS SCHEDULES.
 - b. Preliminary Submittal Schedule.
 - c. Schedule of values and anticipated schedule of payments.
 - d. List of Suppliers and Subcontractors.
 - e. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents.
 - f. Access requirements including roads and barges to be provided by Contractor.
 - g. List of construction equipment proposed for the use on project and plans for providing foundation mats and other protections to prevent damage to existing structures and roadways.
 - h. Emergency contact phone numbers.
 - i. Contractor Job Site Safety Plan.
 - j. Environmental permit and operating requirements.
 - k. Testing procedures and laboratory.
 - l. All other documentation required in Section 00700 – GENERAL CONDITIONS, ARTICLE 2 – PRELIMINARY MATTERS.

Approval to begin the prescribed Work is contingent upon Owner's receipt and examination of the above listed items.

B. Periodic Progress Meetings

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1. Attend meetings with the Engineer and Owner.
 - a. Meet on a weekly basis or as requested by the Owner to discuss the project.
 - b. Meet at the project site or other location as designated by the Owner.
 - c. Contractor's superintendent and other key personnel are to attend the meeting. Other individuals may be requested to attend to discuss specific matters.

2. Provide information as requested by the Owner concerning this project.
 - a. 3-Week Look Ahead Schedule – Bar chart schedule identifying all upcoming work activities, subcontractor coordination, material and equipment deliveries, and any activities requiring coordination with the Owner (revise for each meeting).
 - b. Prepare to discuss:
 - I. Correction to previous meeting's minutes.
 - II. Outstanding issues from previous meetings.
 - III. Status of overall project schedule.
 - IV. Contractor's detailed schedule for the next 3 weeks.
 - V. Anticipated fabrication/delivery dates for equipment and assembled material components.
 - VI. Coordination with the Owner.
 - VII. Status of submittals.
 - VIII. Information or clarification of the Contract Documents.
 - IX. Claims and proposed modifications to the contract.
 - X. Field observations, problems, or conflicts.
 - XI. Maintenance of quality standards.
 - c. Notify the Owner's Representative of any specific items to be discussed a minimum of one (1) day prior to the meeting.

3. Review meeting minutes prepared by Owner and notify the Owner's Representative of any discrepancies within two (2) days of the date of the memorandum.
 - a. Following the date issues, the minutes will stand as shown.
 - b. Corrections will be issued at the following meeting.
 - c. Each item of business shall be numbered to indicate the meeting number and the item number. Items discussed will be documented and old business items will remain on minutes of subsequent meetings until the item is resolved.

1.05 REQUESTS FOR INFORMATION

- A. Submit Request for Information (RFI) to the Owner's Representative to obtain additional information or clarification of the Contract Documents or to obtain review of deviations, substitutions, or non-conforming work.
1. Submit a separate RFI for each item.
 2. Attach adequate information to enable a complete written response without further clarification. Owner's Representative will return requests which do not have adequate information provided with the request for additional information.
 3. A response to the Request for Information will be made only when adequate information is provided by Contractor. Response will be made on the RFI Form. A letter/memo may be attached to the response as needed. Owner will endeavor to provide a response to each RFI within three (3) working days after receiving the complete request from Contractor; however, responses to RFI's requiring Owner's review of changes to design will require up to 14 working days for a response.
 4. Before initiating review, Owner will notify Contractor of Owner's engineering cost to review an RFI that addresses unspecified substitutions, deviations, and non-compliant work.
- B. If the RFI indicates that a contract modification is required, the Owner will initiate a Proposed Contract Modification (PCM) per Section 1.07.

1.06 NOTIFICATION BY CONTRACTOR

- A. Notify the Owner's Representative of:
1. Need for testing.
 2. Intent to work outside regular working hours.
 3. Request to shut down facilities or utilities.
 4. Proposed utility connections.
 5. Required observation by Owner's Representative or inspection agencies prior to covering work.
 6. The occurrence of any spills to soil or water and/or releases of material to the water (accidental or intended, with prior notification of intended).

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7. Any other notifications required by Section 00700 – GENERAL CONDITIONS.

B. Notification must be provided with sufficient time for Owner, owner's Representative and Engineer to respond appropriately to the notification.

C. Use "Notification By Contractor" form.

1.07 REQUESTS FOR MODIFICATIONS

A. Submit a request to the Owner's Representative for any change in the Contract Documents or approval of any deviations, substitutions, or non-compliance from the Contract Documents.

1. Use the "Contractor's Modification Request" (CMR) form. See Section 00860, FIELD COMMUNICATION PLANS AND FORMS.

a. Assign a number to the CMR when issued.

b. Include with the CMR:

i. A complete description of the proposed modification, deviation, substitution, or non-compliant work.

ii. The reason the modification is requested.

iii. A detailed breakdown of the cost of the change (necessary only if the modification requires a change in contract amount). The itemized breakdown is to include:

a. List of materials and equipment to be installed,

b. Manhours for labor by classification,

c. Equipment used in construction,

d. Consumable supplies, fuels, and materials,

e. Royalties and patent fees,

f. Bonds and insurance,

g. Overhead and profit,

h. Field office costs,

i. Home office costs,

j. And other items of cost.

iv. A revised schedule indicating the effect on the critical path for the project and a statement of the number of days the project may be delayed by the modification.

2. A CMR is required for field changes.

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- a. Request must be made a minimum of two (2) weeks in advance of performing the work affected.
 - b. Request for field changes shall be submitted to the Owner's Representative.
 3. A CMR is required for all proposed substitutions, deviations, or non-compliant work from the Contract Documents.
 4. Owner will evaluate the request for a contract modification. Before initiating review, Owner will notify Contractor of Owner's engineering cost to review a CMR that addresses unspecified substitutions, deviations, and non-compliance work.
- B. Owner will initiate changes through the Owner's Representative.
1. Owner's Representative will prepare a description of the proposed modifications to the Contract Documents.
 2. Owner's Representative will use the "Proposed Contract Modification" form. Owner's Representative will assign a number to the PCM when issued.
 3. Contractor shall return PCM with a proposal to incorporate the requested change. Include a breakdown of costs into materials and labor in sufficient detail to allow evaluation by the Owner.
- C. If a contract modification is required, the Owner will issue a Field Order or a Change Order.
1. Modifications to the contract can only be made by a Field Order or a Change Order.
 2. All changes in the project will be documented by Filed Order or by a Change Order.
 3. Field Orders may be issued by the Owner for contract modifications that do not change the contract amount or contract time.
 4. Any modifications that require a change in contract amount or contract time can only be approved by Change Order.
 - a. CMR's and proposals issued by the Contractor in response to a PCM will be evaluated by the Owner.

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- b. When a Change Order is recommended, the Owner will prepare the change order.
 - c. The Change Order will be sent to the Contractor for execution with a copy to the Owner recommending approval.
 - d. Change Orders can only be approved by the Owner.
 - i. Work performed on the proposed contract modifications prior to the approval of the Change Order will be performed at the Contractor's risk.
 - ii. No payment will be made for work on Change Orders until approved by the Owner.
- D. The Contractor may be informed that the proposed modification is not approved and construction is to proceed in accordance with the Contract Documents.
- E. Per requirements of the Texas Administrative Code, Title 30, Chapter 299, all modifications to the contract documents must be approved by the Texas Commission on Environmental Quality (TCEQ) prior to enacting the modifications.

1.08 EMERGENCY WORK

- A. Notify the Owner's Representative immediately of any additional work that must be performed to prevent injury to personnel or damage to existing structures, facilities, utilities, or work in place.
- B. Obtain authorization from the Owner before proceeding, unless immediate action is necessary to prevent injury or damage.

1.09 CLAIMS

- A. Do not perform any work which is considered to be outside the scope of the Contract Documents without an approved Change Order or Field Order.
- B. File notice of claims with the Owner's Representative within 10 calendar days of the event giving rise to the claim.
- C. Provide full documentation within 30 days of notice.
- D. Items not reported within the stipulated time will not be considered.
 - 1. Failure to notify the Owner of potential claims does not allow the Owner to take alternative action to prevent the Contractor from incurring the cost for the item or to perform the work in a different manner.

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2. Failure to notify the Owner does not allow operations to be monitored for the actual cost of performing work.
- E. When complete documentation has been received by the Owner's Representative, the claim will be reviewed in the context of the Contract Documents.
1. If the claim is valid, a Change Order will be prepared and payment of the Change Order will be recommended.
 2. If the claim is not valid, then the claim will be denied with an explanation of the reasons.
 3. Should the Contractor disagree with the decision of the Owner, the Contractor may refuse to do the work.
 - a. If the Owner insists that the work be done, proceed with the work on a time and materials basis.
 - b. The validity of the claim will be resolved at a later time in accordance with the Contract Documents.

1.10 RECORD DRAWINGS

- A. Maintain at the site one (1) complete record copy of:
1. Drawings
 2. Specifications
 3. Addenda
 4. Contract modifications
 5. Approved shop drawings and record data
 6. One (1) set of construction photographs, in addition to the set of photographs provided with monthly invoicing.
 7. Test records
 8. Clarifications and other information provided in RFI responses.
- B. Store documents and samples in the Contractor's Field Office.
1. Documents are to remain separated from documents used for construction. These documents are not to be used for construction.

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2. Provide files and racks for the storage of documents.
3. Provide a secure storage space for the storage of samples.
4. Maintain documents in clean, dry, legible conditions, and in good order.
5. Make documents and samples available at all times for inspection by the Owner's Representative.

C. Marking Drawings

1. Label each document as "Project Record" in in large printed letters.
2. Record information as construction is being performed.
 - a. Do not cover, backfill, or otherwise conceal any work until the required information is recorded.
 - b. Mark drawings to record actual construction, including the following:
 - i. Depths of various elements.
 - ii. Changes of dimension and detail.
 - iii. Changes made by Field Order and Change Order.
 - iv. Details not on the original Contract Drawings.
 - v. Installation data.
 - c. Mark specifications and addenda to record materials and equipment provided.
 - i. Record manufacturer name, trade name, catalog number, and each supplier (with address and phone number) of each product and item of equipment actually installed.
 - ii. Record changes made by Field Order and Change Order.
 - d. Mark additional work or information in erasable pencil.
 - i. Use red for new or revised indication.
 - ii. Use purple for work deleted or not installed (lines to be removed).
 - iii. Highlight in yellow the items constructed per the plans.
 - e. Submit record documents to Owner's Resident Representative for review and acceptance 30 days prior to final completion of the project.
 - i. Provide one (1) set of marked up drawings.
 - ii. Provide six (6) sets of specifications.

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- f. Partial Payment Requests will not be recommended for payment if record documents are found to be incomplete or not in order. Final payment will not be recommended without record documents.

END OF SECTION

SECTION 01 04 10 - JOB MANAGEMENT

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish all equipment, manpower, products, and other associated items necessary to complete the project with an acceptable standard of quality and within the contract time. The project shall be constructed in accordance with current safety practices and OSHA safety standards.
- B. Manage the project site and staging area to facilitate access and control construction operations.
- C. Provide labor, materials, equipment and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the job site. Remove temporary facilities when no longer needed.
- D. Temporary controls shall include the constructing of temporary impounding works, channels, diversions, furnishings and operating pumps, installing piping and fittings, sediment and erosion controls and other construction for control of conditions at the site. Remove temporary controls at the end of the project.

1.02 QUALITY ASSURANCE

- A. Notify the Owner's Resident Representative as required by the provisions of 01040 – PROJECT ADMINISTRATION.
- B. Employ competent workers, skilled in the occupation for which they are employed. Provide only first quality workmanship. Owner's Resident Representative shall determine if the quality of work is acceptable.
- C. A defective product is any product that has been found to not be in compliance with the Contract Documents or is damaged prior to the final completion or becomes non-compliant during the one-year warranty period. Defective products shall be removed from the site immediately.
- D. Defective products may remain at the site if arrangements have been made to allow repair of the product at the site. Clearly mark the product as "defective" until removed or allowable repairs have been completed and approved in writing.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01300 – SUBMITTALS, and shall include:

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1. Copies of Manufacturer's printed instructions to all parties involved in the installation of the product prior to beginning the work. Maintain one copy at the job site until completion of the project.
2. Two (2) copies of reports prepared concerning accidents, injury, or death on the Project site to the Owner's Resident Representative as Record Data.
3. Field notes, sketches, recordings, and computations made by the Contractor as Record Data.
4. Written report of spills or other releases of oil or chemicals to the environment (water, air, soil) including a description of the release (date, time, identify and quantity of material released), cause of release, steps taken to mitigate the effects, the date and description of the remedial activities, and copies of all analytical data on soil and water samples taken to determine the extent of release and/or to document the level of cleanup achieved.
5. Material Safety Data Sheets for products used during construction.
6. Dust suppression/control plans for approval by Owner.

1.04 DUST CONTROL

- A. Provide positive methods to minimize dust raised from construction operations and provide positive means to prevent air-borne dust from disappearing into the atmosphere.
- B. Wet materials and contain rubbish to prevent blown dust.
- C. Provide and maintain positive methods of dust control and apply dust control materials to minimize raising and spreading of dust and dirt from cutting and patching operations.

1.05 STANDARDS

- A. Perform all work to comply with local, State and Federal ordinances and regulations.

1.06 COORDINATION

- A. Coordinate the work of various trades having interdependent responsibilities for installing, connecting to, and place in service such equipment.
- B. Coordinate requests for substitutions to provide compatibility of space, operating elements, effect on the work of other trades, and on the work scheduled for early completion.
- C. Coordinate the use project space and the sequence of installation of equipment and materials.

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- D. Where installation of one part of the work is dependent on installation of other components, either before or after its own installation, schedule construction activities in sequence required to obtain best results.

1.07 PERMITS

- A. Obtain permits and other authorizations necessary to conduct any and all parts of the work. A building permit is not required by Bastrop County.
- B. Arrange for inspections and certification by agencies having jurisdiction over the work. Notify Owner's Resident Representative of scheduled observations.
- C. Make arrangements with private utility companies and pay for fees associated with obtaining services, or for inspection fees.

1.08 POLLUTION CONTROL

- A. Prevent the contamination of soil, water or atmosphere by the discharge of noxious substances or contaminant from construction operations. Provide adequate measures to prevent the creation of air-borne pollutants. Prevent dispersal of pollutants into the atmosphere or water. The Contractor shall not dump or otherwise discharge any fluids into drains or sewers, nor allow any substances to contaminate public waterways in any manner.
- B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage in accordance with Section 01500 – ENVIRONMENTAL PROTECTION REQUIREMENTS.
 - 1. Contain chemicals and fuels in protective areas and do not dump on soil. Dispose of such materials at suitable off-site facilities in an acceptable manner as approved by Owner. Cleanup shall be to background levels (TCEQ Risk Reduction Standard No. 1).
 - 2. If contamination of the soil does occur, excavate contaminated soil and dispose in accordance with Section 01500 – ENVIRONMENTAL PROTECTION REQUIREMENTS.
 - 3. Disposal of the contaminant is to comply with local, State and Federal regulations regarding the disposal of pollutants.
 - 4. Fill resulting excavations with suitable backfill and compact to density of the surrounding undisturbed soil.

1.09 SAFETY REQUIREMENTS

- A. Protect the safety and welfare of workmen on the project, the Owner and the general public around the construction site. The Contractor is solely and completely responsible for safety at the project site. Provide and maintain protective devices to warn and protect

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from hazards at the construction site. Comply with all state and federal safety regulations.

1.10 CONTRACTOR'S USE OF PROJECT SITE

- A. Limit the use of site for work and storage to those areas designated on the Drawings. Coordinate the use of the premises with the Owner's Resident Representative.
- B. Any damage to existing facilities, including contamination, caused by the Contractor's personnel, visitors, materials, or equipment, shall be repaired or corrected at the Contractor's expense.
- C. No alcoholic beverages, tobacco products or illegal substances shall be permitted on the site or any LCRA site at any time, nor will persons under the influence of same be permitted to remain on the premises. Persons on site under the influence of alcoholic beverages or illegal substances will be permanently removed from the site in addition to possible criminal and civil penalties.
- D. Employees' vehicles must be parked in designated areas only, as shown on the drawings. Contractor shall submit a complete list of Contractor's vehicles proposed for use on the project site. Employees shall not be allowed to drive on-site in personal vehicles.
- E. Park all equipment in designated areas only as shown on the drawings or as directed in writing by the Owner's Representative. Provide spill/leak control catch pans and "diaper" equipment as necessary/practical to prevent release of fuels, lubricants, or other fluids.
- F. Enter privately-owned land outside of the Owner's property, rights-of-way, or easements only with written permission of the Owner.
- G. The use of loud radios, obnoxious, vulgar, or abusive language, or sexual harassment in any form will not be tolerated and will be cause for immediate removal of the offender from the premises permanently, in addition to possible criminal or civil penalties.
- H. Workers attire shall be professional and commensurate to the trade. Sleeveless shirts, shorts, exceedingly torn, ripped or soiled clothing shall not be permitted.
- I. Firearms are not permitted on the site under any conditions, including persons with concealed handgun permits.

1.11 ACCESS TO THE SITE

- A. Carefully examine the site and plans, noting areas of restricted access. Evaluate the suitability of proposed construction equipment with respect to dimensions, turning radius, weight, and other characteristics related to site access. Provide a listing of proposed

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equipment with bids including dimensions, gross loaded weight, turning space requirements.

- B. Maintain access to the facilities at all times. Roads, pedestrian walks, or access to the various buildings, structures, stairways, or entrances shall not be obstructed unless approved in writing by Owner. Provide safe temporary walks or other structures to allow access for normal operations during construction.
- C. Provide adequate and safe access for observations by the Owner's Resident Representative. Leave ladders, bridges, and scaffolding in place until observations have been completed. Construct access as required for observations.
- D. Provide security at the construction site and staging area as necessary to protect against vandalism and loss by theft.

1.12 DELIVERY AND STORAGE

- A. Products shall be delivered to the site per the Progress Schedule to prevent delays.
- B. Deliver packaged products to site in original undamaged containers with identifying labels attached. *Open cartons* as necessary to check for damage and to verify invoices. Reseal cartons and store until used. Leave products in packages or other containers until installed.
- C. The Contractor shall assume full responsibility for the protection and safekeeping of products stored at the site. Protect the products until installed.
- D. Store products at location acceptable to the Owner and to allow Owner access for maintenance and operations. Store immediately upon delivery in accordance with the Manufacturer's storage instructions and with seals and labels intact. Arrange storage to allow access for maintenance and inspection of stored items. Store unpacked and loose products on shelves, in bins, or in orderly groups of like items.
- E. Obtain and pay for the use of any additional storage needed for construction. Provide and maintain storage sheds as required for the protection of products. Remove at the completion of the project. Store products subject to damage by elements in substantial weather-tight enclosures or storage sheds of adequate dimensions. Maintain temperature and humidity within the ranges stated in the Manufacturer's instructions. Provide humidity control and ventilation for sensitive products as required by manufacturer's instructions.
- F. Provide adequate exterior storage for products that may be-stored out-of-doors.
 - 1. Provide substantial platforms, blocking, or skids to support fabricated products above ground; slope to provide drainage. Protect products from soiling or staining.

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2. For products subject to dislocation or deterioration from exposure to the elements, cover with impervious sheet materials. Provide ventilation to prevent condensation below covering.
 3. Store loose, granular materials on clean, solid surfaces, or on rigid sheet materials, to prevent mixing with foreign matter. Protect from wind dispersal as necessary to limit emissions and prevent nuisance conditions.
 4. Provide surface drainage to prevent erosion and ponding of water. Culverts shall be provided as needed and as indicated on the Drawings.
 5. Prevent mixing of refuse or chemically injurious materials or liquids with stored materials.
 6. Pipes and conduits stored outdoors are to have open ends sealed to prevent the entrance of dirt, moisture, and other injurious materials.
 7. Store light weight products to prevent wind damage.
 8. Stationary fuel, oil, and liquid chemical tanks/drums shall be placed within suitable secondary containment for storage.
- G. Maintain storage facilities. Inspect stored products on a weekly basis and after periods of severe weather to verify that:
1. Storage facilities continue to meet specified requirements.
 2. Manufacturer's required environmental conditions are continually maintained.
 3. Surfaces of products exposed to the elements are not adversely affected and that weathering of finishes is within acceptable tolerances to provide a finished project meeting the requirements of the Contract Documents.
- H. Replace at no additional cost any stored item damaged due to inadequate protection or environmental controls.
- I. Payment may be withheld for any products not properly stored.

1.13 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. Examine the project site and review available information concerning the site. Locate utilities, streets, driveways, fences, drainage structures, sidewalks, curbs, and gutters. Verify the elevations of the structures adjacent to excavations. Report these to the Owner's Resident Representative before beginning construction.
- B. Prepare a Plan of Action per Section 01030 – SPECIAL PROCEDURES. Determine if existing structures, poles or other utilities will require relocation or replacement. Coordinate work with Owner's Resident Representative, local utility company, and others. Include cost of demolition and replacement or relocation of these structures in the price proposal (bid) amount.
- C. Structures not to be replaced or relocated shall be protected from damage during construction. Structure or utilities damaged during or as a result of construction shall be

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restored to a condition matching or better than that which existed before the start of construction. Include cost of restoration or replacement in the price proposal (bid).

- D. Provide a pre-installation and post-installation survey of the structures.
- E. Protect existing trees, landscaping and vegetation at the site.
 - 1. Visit site with Owner's Resident Representative to identify trees and vegetation that may be removed during construction.
 - 2. Mark trees and vegetation to be removed.
- F. Protect structures from damage when handling material or equipment. Protect finished surfaces. **Repair** or replace materials or structures damaged by handling or equipment to the Owner's satisfaction at no additional cost.

1.14 CLEANING DURING CONSTRUCTION

- A. Clean the project area as work progresses and dispose of waste materials, keeping the site free from accumulations of waste or rubbish. Provide containers on site for waste collection.
- B. Use only those cleaning products that will not create hazards to health, property, or the environment, and those methods recommended by the Manufacturer on the surfaces to be cleaned. Use cleaning products only on those surfaces recommended by the cleaning product Manufacturer.
- C. Comply with codes, ordinances, regulations, and anti-pollution laws. Waste materials shall not be burned or buried. Waste materials shall not be dumped on the ground or disposed of in storm or sanitary sewers or waterways.
- D. Transport waste materials in a controlled manner with as few handlings as possible. Materials shall not be dropped from heights.
- E. Remove non-hazardous waste materials, rubbish, and debris from the site and legally dispose of these at a permitted sanitary or construction landfill. Coordinate and obtain prior approval of disposal facility to be used from Owner's Resident Representative and Owner's Environmental Management Section.
- F. Waste materials or debris shall be properly contained and appropriately label on-site at all times prior to removal and disposal.
- G. At least daily, Contractor shall clean the jobsite and collect rubbish and any other debris in areas surrounding the jobsite.

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- H. Unless otherwise directed through written instructions issued by the Owner's Resident Representative, Contractor shall promptly remove from project site any and all surplus materials. Final payment for performance of the Work shall be due and payable until such materials are removed from the project site. If surplus materials are not removed from the jobsite within thirty (30) days of completion of the Work, Owner may dispose of the materials and offset the cost associated with disposal against the unpaid balance of the Contract Price.

1.15 MAINTENANCE OF ROADS, DRIVEWAYS AND ACCESS

- A. Construct temporary detours, including by-pass roads around construction to maintain the flow of traffic at all times. Public roads shall not be closed overnight.
- B. Maintain sufficiently clear width of the road for the free flow of traffic.
- C. The Contractor shall assume responsibility for any damage resulting from construction along roads or drives.
- D. Any driveway off of a public roadway installed for the purpose of this project shall have a stabilized construction entrance to minimize tracking of sediment onto the roadway.
- E. Construction access driveways opening onto public roadways shall have appropriate traffic warning signs and other warning devices as necessary. Flagmen shall be used when delivering or removing heavy equipment and material deliveries to and from the site.

1.16 TRAFFIC MAINTENANCE

- A. Roads and streets shall remain open during all phases of construction, unless the Owner approves a street closing. In addition, obtain necessary approvals from City of Austin prior to a partial or complete closing.
- B. Submit a written request for the Owner's approval of a street closing. The request shall state:
1. Reason for closing the street.
 2. How long the street will remain closed.
 3. Procedures to be taken to maintain the flow of traffic.
- C. Provide temporary access around the closed street by constructing a temporary paved road at locations necessary to allow the Owner access to the remainder of the site.
- D. Maintain barricades, signs and safety features around the detour and excavations.

1.17 FIELD MEASUREMENTS

- A. Perform complete field measurements of the dimensions at the site for products required to fit existing conditions prior to purchasing products affected by that measurement or beginning construction.
- B. Verify property lines, control lines, grades and levels indicated on drawings.
- C. Check shop drawings and indicate the actual dimensions available where products are to be installed.
- D. Include field measurements in record drawings as required in Section 01040 – PROJECT ADMINISTRATIONS.

1.18 REFERENCE DATA AND CONTROL POINTS

- A. Contractor shall determine the following control points before beginning construction on the gate:
 - 1. Base line or grid reference points for horizontal control.
 - 2. Vertical control benchmark for vertical control.
- B. Locate and protect control points prior to starting the site work and preserve permanent reference points during construction. The Contractor shall not change or relocated points without prior approval of the Owner. Notify Owner's Resident Representative when the reference point is lost, destroyed, or requires relocation. Replace project control points to original horizontal and vertical position on the basis of the original survey.
- C. Provide complete layout of the work needed for construction.
 - 1. Provide competent personnel. Provide equipment including accurate surveying instruments, stakes, markers, platforms, tools and materials.
 - 2. Survey accuracy is to meet the requirements established for Category 5 Construction Surveying as established in the Manual of Practice of Land Surveying in Texas published by the Texas Society of Professional Surveyors, latest revision.
 - 3. Record data and measurements per standards. Provide all such measurements and data to the Owner as requested.

1.19 ARCHAEOLOGICAL REQUIREMENTS

- A. If an historical or archaeological find is made during construction, cease operations immediately and contract the Owner's Resident Representative for instructions.

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B. Where significant historical or archaeological sites have already been identified within the project site, all construction activities must be conducted to avoid adverse impact on these sites.

1. The Contractor will be provided with details to assist in the work protection of these areas.
2. All information regarding the site shall remain confidential.
3. The Contractor shall assume responsibility for any unauthorized destruction that might result to such sites by construction personnel, and shall pay all penalties assessed by the State or Federal agencies for non-compliance with these requirements.
4. The Contractor shall adhere to the requirements of the Texas Historical Commission.

C. Archaeological sites shall not be disturbed.

1. The Owner's archaeological contractor will be available to instruct construction personnel on how to identify and protect archaeological finds on an emergency basis.
2. Coordinate activities to permit Archaeological work to take place within the area.
 - a. The Owner will attempt to archaeologically clear areas needed for construction as soon as possible.
 - b. The Contractor shall provide a determination of priority for such areas.

D. Contract time will be modified to compensate for delays caused by such archaeological finds. No additional compensation shall be paid for delays.

1.20 INITIAL MAINTENANCE

A. Maintain equipment until the project is accepted by the Owner. Ensure that mechanical equipment is properly lubricated and cared for as recommended by the Manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials shall be in accordance with the requirements of the individual sections.

PART 3 EXECUTION

Perform the work per the Manufacturer's current published instructions.

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END OF SECTION

SECTION 01 13 00 - MEASUREMENT AND PAYMENT

PART 1: GENERAL

1.01 WORK INCLUDED

- A. Payments for work shall conform with the provisions of the GENERAL CONDITIONS, THE SUPPLEMENTAL GENERAL CONDITIONS, the Bid Form, the Agreement and this Section.
- B. Submit request for partial payment at the prices indicated in the Proposal.
 - 1. Prices for each bid item in the Proposal shall include but not be limited to cost for:
 - a. Mobilization, demobilization, cleanup, bonds, and insurance.
 - b. Professional services including but not limited to engineering and legal fees.
 - c. Products to be permanently incorporated into the project.
 - d. Products consumed during the construction of the project.
 - e. Labor and supervision to complete the work.
 - f. Equipment, including tools, machinery, and appliances required to complete the project.
 - g. Field and home office administration and overhead costs related directly or indirectly to the project.
 - h. Warranties.
 - 2. Prices bid shall include the work not specifically set forth as an individual payment item. These items are considered to be subsidiary obligation of the Contractor and the cost for these items shall be included in the bid prices.
 - 3. Payment shall be based on the actual quantity of work completed and per Contract Documents as measured per this section.
 - 4. Payment will be made for Materials-On-Hand.
 - a. Materials must be properly stored on the project site at the dam per Section 01041 – JOB MANAGEMENT.
 - b. Payment may be made for the invoice amount less the specified retainage.
 - c. Invoices must be provided at the time they are included on the Materials-on-Hand tabulation.
 - d. Documentation of payment for Materials-on-Hand must be provided for these items with the next payment request. Payment will be adjusted to the amount actually paid if this differs from the invoice amount. If this documentation is not provided, the item must be removed from the Materials-on-Hand list and payment will be withheld.

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- e. Payment for Materials-on-Hand is provided for the convenience of the Contractor and does not constitute acceptance of the product.
 - f. No payment for the Materials-on-hand shall be approved without an approval submittal for the respective material.
5. The work covered by Progress Payments shall become the property of the Owner at the time of payment. Materials on hand shall become the property of the Owner only upon permanent incorporation into the work covered by Progress Payments. Payment will not constitute acceptance of the Work by Owner.

C. Application for payment shall be submitted per the provisions of this Section.

1.02 SCHEDULE OF VALUES AND PAYMENTS.

A. Submit a detailed schedule of values for the work to be performed on the project.

- 1. Submit schedule of values within 14 calendar days following Notice of Award, but no later than at the Pre-Construction meeting.
- 2. Line items in the proposal are to be used as line items in the schedule.
- 3. Payment will be made on the work completed per Contract Documents during the payment period and as measured per this Section.
 - a. Payment amount shall be the work quantity measured multiplied by the unit prices for that line item in the Proposal.
 - b. Payment on a unit price basis will not be made for work outside finished dimensions shown in the Contract Documents.
 - c. Partial payments will be made for lump sum line items in the Proposal.
 - i. Lump sum line items in the Proposal are to be divided to allow easy determination of the percentage of the item that has been completed.
 - a. Provide adequate detail to allow easy determination of the percentage of work completed for each item.
 - b. Items, with the exception of equipment packages, are not to exceed \$50,000.
 - c. Separate product costs and installation costs.
 - i. Product costs include cost for product, delivery and unloading costs, royalties, and patent fees, taxes, and other cost paid directly to the supplier or vendor.
 - ii. Installation costs include cost for the supervision, labor and equipment for field fabrication, erection, installation, start-up, initial operation and Contractor's overhead and profit.
 - d. Lump sum items may be divided into an estimated number of units.

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- i. The estimated number of units times the cost per unit must equal the lump sum amount for that line item.
 - ii. Contractor will receive payment for all of the lump sum line item.
 - e. Include a directly proportional amount of the Contractor's overhead and profit for each line item.
 - f. Divide principal subcontract amounts into an adequate number of line items to allow determination of the percentage of work completed for each item.
 - ii. These line items may be used to establish the value of work to be added or deleted from the project.
 - iii. Correlate line items with other administrative schedules and forms:
 - a. Progress schedule
 - b. List of subcontractors
 - c. Schedule of allowances
 - d. Schedule of alternatives
 - e. List of products and principal suppliers
 - f. Schedule of submittals
 - iv. Costs for mobilization and demobilization shall be listed as a separate line item and shall be actual cost for:
 - a. Bonds and insurance.
 - b. Transportation and setup and removal for equipment.
 - c. Transportation and erection and removal of all field offices, sheds and storage facilities.
 - d. Salaries for preparation of submittals required before the first payment request and for project close-out and for the one-year warranty.
 - e. Salaries for field personnel assigned to the project related to the mobilization and demobilization of the project.
 - f. Cost for mobilization and demobilization may be submitted only for work complete.
 - g. Compensation for mobilization and demobilization shall not exceed ten percent (10%) of the total amount of the BASE BID.
 - v. The sum of all values listed in the schedule shall equal the total contract amount.
- B. Submit a schedule indicating the anticipated schedule of payments to be made by the Owner.
- 1. Schedule shall indicate:
 - a. The payment request number.
 - b. Date the request is to be submitted.

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- c. Anticipated amount of the payment request.
- 2. Schedule shall be updated monthly or more often if requested by the Owner to provide a reasonable accurate indication of the funds that the Owner will need to have available to make payment to the Contractor for the work performed.
- C. Provide written approval of the Schedule of Values, Payment Request Form, and method of payment by the Surety Company providing performance and maintenance bonds prior to submitting the first Payment Request. Payment will not be made without this approval.

1.03 PAYMENT PROCEDURES

- A. Submit payment requests per the submittal procedures indicated in Section 01300 – SUBMITTALS.
- B. Requests shall be submitted on a pre-printed form as indicated in Section 00860 – FIELD COMMUNICATION PLAN AND FORMS, or may be generated by computer. Computer generated payment requests must have the same format and information indicated in the pre-printed form and shall be approved by the Owner.
 - 1. Submit a Schedule of Values in the payment request format to be used.
 - a. Request must include a completed Summary of Payment Request Values with each estimate submitted.
 - i. Each request must be sequentially numbered and the payment period indicated.
 - ii. Total amounts for Value of Original Contract Performed, Extra Work on Approved Change Orders, and Materials-on-Han are to be shown on the Summary Sheet and are to correspond to totals indicated on the attached tabulation for each.
 - iii. The number of pages included in each tabulation is to be noted in the blank space on the Summary Sheet to allow a determination to be made that all sheets have been submitted.
 - iv. Contractor's certification must be executed by the Contractor's agent of authority each payment request.
 - b. The Tabulation of Values for Original Contract Performance is to indicate the total contract amount and the work completed to date.
 - c. The Tabulation of Extra Work on Approved Change Orders is to include only approved Change Order items.

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- d. The Tabulation of Materials-on-Hand is to list all materials that are presented for payment. Once an item has been entered on the tabulation, it is not to be removed.
 - e. Project Summary Report is to be included with each payment request. Data included in the Project Summary Report are to be taken from other tabulations.
 2. The Schedule of Values and the form for the submission of requests shall not be altered without the express written consent of the Owner and Surety Company once these have been approved by the Owner and Surety Company.
 3. Final payment requires additional procedures and documentation per Section 01700 – CONTRACT CLOSEOUT.
- C. Progress payments shall be made as the work progresses on a monthly basis as described in the General Conditions.
 1. The payment period shall end on a day of each month mutually agreed upon by the Owner and Contractor and shall cover all work completed and materials received since the end of the last payment period.
 2. After the end of the payment period, submit a draft copy of the payment request for the month to the Owner's Resident Representative. Agreement is to be reached on:
 - a. The percentage of work completed for each lump sum item.
 - b. The quantity of work completed for each unit price item.
 - c. The percentage of work completed for each approved Change Order item.
 - d. The amount of Materials-on-Hand.
 - e. Status of documentations for record drawings.
 3. On the basis of these agreements, the Contractor is to prepare a final copy of the payment request and submit it to the Owner's Resident Representative for approval.
 - a. The final copy is to be signed by the representative of the Contractor authorized to execute documents for the Contractor and notarized.
 - b. The Owner's Resident Representative will review the payment request and, if appropriate, will recommend payment of the request to the Owner.
- D. Each payment request shall be accompanied by an updated project progress schedule per Section 01310 – PROGRESS SCHEDULES.
- E. Each payment request is to be accompanied by Project Photographs per Section 01380 – PROJECT PHOTOGRAPHS.

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1.04 ALTERNATES

- A. This bid form (Section 00300U) identifies each alternate bid number and describes the basic changes to be incorporated into the work when this alternate is made a part of the work in the Contract Agreement.
- B. Drawings and Specifications will outline the extent of work to be included in the Alternate Bid.
- C. Coordinate related work and modify surrounding work as required to properly integrate the work under each Alternate, and provide a complete and functional system as required by the Contract Documents.
- D. Provide submittals for products furnished as part of the alternate proposal per Section 01300 – SUBMITTALS.

END OF SECTION

SECTION 01 30 00 - SUBMITTALS

PART 1: GENERAL

1.01 WORK INCLUDED

- A. Submit documentation as required by the Contract Documents and as reasonably requested by the Owner, Engineer, and Owner's Resident Representative to:
 - 1. Record the products incorporated into the Project for the Owner.
 - 2. Provide information for operations and maintenance of the Project.
 - 3. Provide information for the administration of the Contract.
 - 4. Allow the Engineer to advise the Owner if products proposed for the project by the Contractor conform, in general, with the design concepts of the Contract Documents.
- B. Contractor shall prepare submittals, correspondence, and project documentation in accordance with Section 00860 – FIELD COMMUNICATION PLAN AND FORMS, which has been developed from sections of the LCRA IMPLEMENTATION PLAN.
- C. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the Owner's or Engineer's review of submittals. Contract modifications may only be approved by Change Order or Field Order.

1.02 CONTRACTOR'S RESPONSIBILITIES

- A. Review all submittals prior to submission. Provide certification of the accuracy and completeness of the submittal in accordance with the SUPPLEMENTAL GENERAL CONDITIONS.
- B. Determine and verify:
 - 1. Field measurements.
 - 2. Field construction requirements.
 - 3. Location of all existing structures, utilities and equipment related to the submittals.
 - 4. Submittals are complete for their intended purpose.
 - 5. Conflicts between the submittals related to the various subcontractors and suppliers have been resolved.
 - 6. Quantities and dimensions shown on the submittals.
- C. Submit information per the procedures described in this section and the detailed specifications.
- D. Furnish the following submittals:

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1. Schedules, data and other documentation as described in detail in this section or referenced in the General Conditions.
 2. Documentation required for the administration of the Contract per Section 01040 – PROJECT ADMINISTRATION.
 3. Shop drawings required for consideration of a contract modification per Paragraph 1.08.
 4. Submittals as required in the detailed specifications.
 5. Submittals not required will be returned without Owner's or Engineer's review.
- E. Submit a schedule indicating the date submittals will be sent to the Owner's Resident Representative and proposed dates that the product will be incorporated into the project. Make submittals promptly in accordance with the schedule so as to cause no delay in the project.
1. Submittals shall be sent to Owner's Resident Representative allowing a reasonable time for delivery, review and marking of submittals. Time for review is to include time for resubmission if necessary, and to allow adequate time for the ordering, fabrication and delivery of the product.
 2. Schedule submittal to provide all information for interrelated work at one time. No review will be performed on submittals requiring coordination with other submittals. Owner's Resident Representative will return submittals for resubmission as a complete package.
- F. Submittals for systems and related equipment shall include information for all of the components required for a complete and operational system.
1. Include electrical, mechanical, and other information required to indicate how the various components of the system function.
 2. Where certifications, warranties, and written guarantees are required, they shall be provided with the submittal package for review.
- G. Fabrication or installation of any products prior to the approval of shop drawings is done at the Contractor's risk. Products not meeting the requirements of Contract Documents are defective and may be rejected at the Owner's option.
- H. Payment will not be made for products for which submittals are required until the submittals have been received. Payment will not be made for products for which shop drawings or samples are required until these are approved by the Owner.

1.03 QUALITY ASSURANCE

- A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Submittals not meeting this criteria will be returned without review.

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- B. Demonstrate that the proposed products are in full and complete compliance with the design criteria and requirements of the Contract Documents including drawings and specifications as modified by Addenda, Field Orders and Change Orders.
- C. Furnish and install products that fully comply with the information included in the submittal.
- D. Review and approve submittals prior to submitting them to the Owner for review. Submittals will not be accepted from subcontractors, suppliers, or anyone other than the Contractor.

1.04 SUBMITTAL PROCEDURES

- A. Deliver submittals to the Owner's Resident Representative at the address provided at the pre-construction meeting.
- B. Transmit all submittals, with a properly completed Submittal Transmittal Form.
 - 1. A separate transmittal form shall be used for each specific product, class of material, and equipment system.
 - 2. Items specified in different sections of the specifications are to be submitted separately unless integrally related.
- C. Assign a number to the documents originated to allow tracking of the submittal during the review process.
 - 1. Assign a number consisting of a prefix, a sequence number, and a letter suffix.
 - 2. Issue sequence numbers in chronological order for each type of submittal.
 - 3. Issue numbers for resubmittals that have the same number as the original submittal followed by an alphabetical suffix indicating the number of times the same submittal has been sent to the Owner for processing. For example: SD-025-A represents a shop drawing that is the twenty-fifth submittal of this type and is the second time this submittal has been sent to the Owner for review.
 - 4. Clearly note the submittal number on each page or sheet of the submittal.
 - 5. Correct assignment of numbers is essential since different submittal types are processed in different ways.
- D. Submit documents with uniform markings and page sizes.
 - 1. Paper size shall allow for ease of reproduction.
 - a. Submit documents on 8-1/2" X 11" paper where practical.
 - b. Use 11" X 17" paper for larger drawings and schematics.
 - c. Use full size reproducible sheets for fabrications and layout drawings.
 - 2. Mark submittals to:

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- a. Indicate Contractor's corrections in green.
 - b. Highlight items pertinent to the products being furnished in yellow and delete items that are not when Manufacturer's standard drawings or information sheets are provided.
 - c. Cloud items and highlight in yellow where selections by the Owner are required.
 - d. Mark dimensions with the prefix FD to indicate field verified dimensions on the drawings.
 - e. Provide a blank space 8" x 3" for Contractor's and Engineer's stamps.
3. Define abbreviations and symbols used in shop drawings.
- a. Use terms and symbols in shop drawings consistent with the Contract Drawings.
 - b. Provide a list of abbreviations and their meaning as used in the shop drawings.
 - c. Provide a legend for symbols used on shop drawings.
- E. Mark submittals to reference the drawing number and/or section of the specifications, detail designation, schedule or location that corresponds with the data submitted. Other identification may also be required, such as layout drawings or schedules to allow the reviewer to determine where a particular product is to be used.
- F. Deliver samples required by the detailed specifications to the project site. Provide a minimum of two (2) samples.
- G. Construct mock-ups from the actual products to be used in construction per detailed specifications.
- H. Submit Contractor's Modification Request per Section 01040 – PROJECT ADMINISTRATION to request modification to the Contract Documents.
- I. Coordination between the Owner and Contractor to identify the number of copies of each submittal to be sent by the Contractor and the number of copies of each submittal to be returned.

1.05 REVIEW PROCEDURES

- A. Shop drawings shall be reviewed in the order received.
1. The Contractor may mark submittals as "Priority" for review. Contractor should use discretion in the use of "Priority" submittals as this may delay review of submittals previously submitted.
 2. Priority submittals will be reviewed before other submittals for this project which have been received but not reviewed.

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3. Revise the Schedule of Contractor's Submittals for substantial deviations from the previous schedule.
- B. Review procedures vary with the type of submittal as described in Paragraph 1.06.
- C. Owner will reject any submittal which does not conform to the Contract Documents which contains deviations and substitutions which the Owner has not approved.

1.06 SUBMITTAL REQUIREMENTS

- A. Shop drawings are required for those products that cannot adequately be described in the Contract Documents to allow fabrication, erection or installation of the product without additional detailed information from the product's manufacturer.
 1. Shop drawings are requested so that the Owner or Engineer can:
 - a. Assist in selecting colors, textures or other aesthetic features.
 - b. Compare the proposed features of the product with the specified features so as to determine that the product does, in general, conform to the Contract Documents.
 - c. Compare the performance features of the proposed product with those specified so as to determine that the product will meet the designed performance criteria.
 - d. Review required certifications, guarantees, warranties and service agreements for compliance with the Contract Documents.
 2. Contractor shall certify that he has reviewed the shop drawings and made all necessary corrections such that the products, when installed, will be in full compliance with the Contract Documents, per Section 00810 – SUPPLEMENTAL GENERAL CONDITIONS. Shop drawings submitted without this certification will be returned without review.
 3. Submit shop drawings for;
 - a. Products where shop drawings provide better documentation of the proposed product installation.
 - b. When a substitution or equal product is proposed in accordance with Paragraph 1.08.
 4. Include a complete description of the materials or equipment to be furnished. Information is to include:
 - a. Type, dimensions, size, arrangement, model number and operational parameters of the components.
 - b. Weights, gauges, materials of construction, external connections, anchors and supports required.

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- c. Performance characteristics, capacities, engineering data, and other information necessary to allow a complete evaluation of components.
 - d. All applicable standards such as ASTM or Federal specification numbers.
 - e. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns and coordination drawings.
 - f. Mix designs for concrete, grout, or other materials proportioned for the project.
 - g. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the submittal that the measurements represent actual dimensions obtained at the site.
 5. All required statements of certification, guarantees, extended service agreements, and other related documents are to be provided with the shop drawings. The effective date of these documents shall be the date of final acceptance of the work by the owner.
 6. Comments will be made on items called to the attention of the Owner or Engineer for review and comment. Any marks made by the Owner or Engineer do not constitute a blanket review of the submittal or relieve the Contractor from responsibility for errors or deviations from the Contract requirements.
 - a. Submittals that are reviewed shall be returned with one or more of the following designations:
 - i. Approved – Submittal is found to be acceptable as submitted.
 - ii. Approved as Corrected – Submittal is acceptable with corrections marked by Contractor or notations made by Owner or Engineer and may be used as corrected.
 - iii. Revise and Resubmit – Submittal has deviations from the Contract Documents, significant errors, or is inadequate and must be revised and resubmitted for subsequent review.
 - iv. Not Approved – Products are not acceptable.
 - b. Drawings with a significant or substantial number of markings by the Contractor may be marked “Approved as Corrected” and “Revise and Resubmit”. These drawings are to be revised to provide a clean record of the submittal.
 - c. Dimensions or other data that do not appear to conform to the Contract Documents will be marked as “At Variance With” (AVW) the Contract Documents or other information provided. The Contractor is to make revisions as appropriate to comply with Contract Documents.
- B. Certifications, Warranties and Service Agreements include documents as specified in the detailed specifications, or as follows:
 1. Certified Test Reports (CTR) – A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with specifications.
 2. Certification of Applicator/Subcontractor (CSQ) – A certified letter stating that the Applicator or Subcontractor proposed to perform a specified function is

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duly designated as factory authorized and trained for the application of the specified product.

- C. Submit record data to provide information to allow the Owner to adequately identify the products incorporated into the project and allow replacement or repair at some future date.
1. Provide record data for all products. Record date is not required for items for which shop drawings are required.
 2. Provide information only on the specified products. Submit a Contractor's Modification Request for approval of deviations or substitutions and obtain approval by Field Order or Change Order prior to submitting Record Data.
 3. Provide the same information required for shop drawings.
 4. Record data will be received by the Owner's Resident Representative, logged, and provided to owner for his record.
 - a. Record date may be reviewed to see that the information provided is adequate for the purpose intended. Inadequate drawings may be returned as unacceptable.
 - b. Record data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.
- D. Provide samples for comparison with products delivered to the site for use on the project.
1. Samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices.
 2. Indicate the full range of color, texture, and patterns.
 3. Dispose of samples when related work has been completed and approved, and disposal is requested by the Owner's Representative. At Owner's option, samples will become the property of the Owner.
- E. Construct mock-ups for comparison with the work being performed.
1. Construct mock-ups of the size or area indicated in the detailed specification.
 2. Construct mock-ups complete with texture and finish to represent the finished product.
 3. Protect mock-ups until work has been completed and accepted by the Owner.
 4. Dispose of mock-ups when related work has been completed and disposal is approved by the Owner.
- F. Submit Operation and Maintenance manuals (O&M) for all equipment, mechanical devices, or components described in the Contract Documents per Section 01730 – OPERATION AND MAINTENANCE MANUALS. Include copies of approved shop drawings in the manual.

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- G. Submit Request for Information (RFI) in accordance with Section 01040 – PROJECT ADMINISTRATION.
- H. Submit a Schedule of Values and Payment Requests (PR) in accordance with Section 01130 – MEASUREMENT AND PAYMENT.
- I. Submit Progress Schedules (SCH) in accordance with Section 01310 – PROGRESS SCHEDULES.
- J. Submit Certified Test Report (CTR) from independent testing laboratories in accordance with Section 01400 – QUALITY CONTROL.
 - 1. Submit test reports for material fabricated for this project with shop drawings for that product.
 - 2. Submit test reports produced at the point of production for standard production products with the record data for that product.
- K. Submit a list of Suppliers and Subcontractors as Record Data in accordance with Section 01040 – PROJECT ADMINISTRATION.
- L. Submit Notifications by Contractor (NBC) in accordance with Section 01040 – PROJECT ADMINISTRATION.
- M. Submit Project Photographs (PP) in accordance with Section 01380 – PROJECT PHOTOGRAPHS.

1.07 REQUESTS FOR APPROVAL OF DEVIATIONS AND NONCOMPLIANT WORK AND PRODUCTS

- A. Submit requests for Owner's approval of deviations and non-compliance from the Contract Documents for any product or work that does not fully comply with the specifications.
- B. Submit request by using the Contractor's Modification Request (CMR), per Section 01040 – PROJECT ADMINISTRATION. Identify the deviations and the non-compliant work and products and the reason the change is requested.
- C. Deviations and non-compliance that result in a reduction in cost shall also include the amount of the reduction to the Owner.
- D. A Change Order or Field Order will be issued by the Owner for deviations and non-compliant work and products approved by the Owner. Owner's approval of deviations from the Contract Documents and non-compliant work and products shall only be approved by Change Order or Field Order.

1.08 SUBMITTALS FOR EQUAL NON-SPECIFIED PRODUCTS

- A. The products of the listed suppliers are to be furnished where detailed specifications list several manufacturers but do not specifically list “or equal” or “or approved equal” products. Use of any products other than those specifically listed is a substitution and must be approved per Paragraph 1.09.
- B. Contractor may submit other manufacturers’ products that are in full compliance with the specification where detailed specifications list one or more manufacturers followed by the phrase “or equal” or “or approved equal”.
 1. Submit shop drawings of adequate detail to document that the proposed product is equal or superior to the specified product.
 2. Prove that the product is equal. It is solely the Contractor’s responsibility to prove that the product is equal. It is not the Owner’s or Engineer’s responsibility to prove the product is not equal.
 - a. Indicate on a point by point basis for each specified feature that the product is equal to the Contract Document Requirements.
 - b. Make a direct comparison with the specified manufacturer’s published data sheets and available information. Provide this printed material with the submittal.
 - c. The decision of the Owner regarding the acceptability of the proposed product is final.
 3. Provide a written certification that, in furnishing the proposed product as an equal, the Contractor:
 - a. Has thoroughly examined the proposed product and has determine that it is equal or superior in all respects to the product specified.
 - b. Had determined that the product will perform in the same manner and result in the same process as the specified product.
 - c. Will provide the same warranties and/or bonds for the product specified.
 - d. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the product into the construction and will waive all claims for additional work which may be necessary to incorporate the product into the project which may subsequently become apparent.
 - e. Will maintain the same time schedule as for the specified product.
 4. A modification request is not required for any product that is in complete compliance with the Contract Documents.

1.09 SUBMITTALS FOR SUBSTITUTIONS

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- A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified.
- B. If the Contractor desires to submit a manufacturer or product which is not specified, the Contractor must submit the following for consideration of approval of the substitution:
 - 1. Contractor's Modification Request for Owner's approval of the deviation from the Contract Documents per Paragraph 1.07.
 - 2. Proof that the product is acceptable as a substitute. It is solely the Contractor's responsibility to prove that the product is acceptable as a substitute.
 - a. Indicate on a point by point basis for each specified feature that the product is acceptable to meet the intent of the Contract Documents requirements.
 - b. Make a direct comparison with the specified manufacturer's published data sheets and available information. Provide this printed material with the submittal.
 - c. The decision of the Owner regarding the acceptability of the proposed substituted product is final.
 - 3. Provide a written certification that, in making the substitution request, the Contractor:
 - a. Has thoroughly examined the proposed product and has determined that it is equal or superior in all respects to the product specified.
 - b. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product.
 - c. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the Manufacturer of the specified product.
 - d. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the substituted product into the project and will waive all claims for additional work which may be necessary to incorporate the substituted product into the project which may subsequently become apparent.
 - e. Will maintain the same time schedule as for the specified product.
- D. A Change Order or Field Order will be issued by the Owner for approved substitutions.

1.10 GUARANTEES

- A. Warranties and guarantees shall be submitted as required by the Contract Documents and submitted with the shop drawings or record data.

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- B. Additional copies shall be provided for equipment and will be included in the Operation and Maintenance Manuals. Refer to Section 01730 – OPERATION AND MAINTENANCE MANUALS.

1.11 RESUBMISSION REQUIREMENTS

- A. Make all corrections or changes in the submittals required by the Owner’s reviewer and resubmit until approved.
- B. For shop drawings:
 - 1. Revise initial drawings or data and resubmit as specified for the original submittal.
 - 2. Highlight in yellow those revisions which have been made in response to the first review by the Owner’s reviewer.
 - 3. Highlight in blue any new revisions which have been made or additional details of information that has been added since the previous review by the Owner’s reviewer.
- C. For samples:
 - 1. Submit new samples as required for the initial sample.
 - 2. Remove samples which have been rejected.
- D. For mock-ups:
 - 1. Construct a new mock-up as initially required.
- E. Need for more than one resubmission or any other delay of obtaining Owner’s review of submittals, will not entitle the Contractor to an extension of Contract Time. All costs associated with such delays shall be at the Contractor’s expense.

1.13 BASELINE PROGRESS SCHEDULE AND SCHEDULE OF VALUES

Prior to mobilization or commencement of any construction activities, Contractor shall submit for examination by Owner the Base-Line progress schedule as required by Section 01310 – PROGRESS SCHEDULES and the Schedule of Values as required by Section 01130 – MEASUREMENT AND PAYMENT.

END OF SECTION

SECTION 01 31 00 - PROGRESS SCHEDULES

PART 1: GENERAL

1.01 REQUIREMENTS

- A. Prepare and submit a progress schedule for the work and update the schedule on a weekly basis, to be submitted to the Owner's Representative at the weekly construction progress meeting, for the duration of the project.
- B. Provide a schedule in adequate detail to allow Owner to monitor the work progress, to anticipate the time and amount of progress payments, and to relate submittal processing to sequential activities of the work.
- C. Incorporate and specially designate the dates of anticipated submission of submittals and the dates when submittals must be returned to the Contractor into the schedule.
- D. Assume complete responsibility for maintaining the progress of the work per the schedule submitted.
- E. Take into consideration when preparing schedule, all requirements in Section 01030 – SPECIAL PROCEDURES.
- F. Prepare and submit schedules in MS Project 2013 Format.
- G. Designate a target "Baseline" schedule.

1.02 SUBMITTALS

- A. Submit progress schedules in accordance with Section 01300 – SUBMITTALS and the LCRA Implementation Plan. Submit schedules within the following times:
 - 1. Baseline Schedule including but not limited to work activities and submittals within 14 calendar days after the Notice of Award. The schedule is to be available at the pre-construction conference.
 - 2. Detailed schedule within 7 calendar days following Notice to Proceed.
- B. Submit progress schedules with requests for partial payment. Schedules may be used to evaluate the requests for partial payment. Failure to submit the schedule may cause delay in the review and approval progress payments.
- C. Submit progress schedule updates on a weekly basis.
- D. Submit schedules in both hard copy and electronic format. Hard copies shall be in color.

1.03 SCHEDULE REQUIREMENTS

- A. Schedule is to be in adequate detail to:
1. Facilitate adequate planning, scheduling, and reporting during the execution of the work.
 2. Enable coordination of the work of the Contractor and the various subcontractors and suppliers.
 3. Assist in monitoring the progress of the work.
 4. Assist in evaluating proposed changes to the contract and project schedule.
 5. Assist the Owner in review of Contractor's payment requests.
 6. Identify Substantial Completion and Final Completion as schedule milestones.
- B. Provide personnel with five (5) years minimum experience in scheduling construction work comparable to this project.
- C. Provide the schedule in the form of a time scaled chart which indicates graphically the work schedule at any time during the project. The graph is to indicate:
1. Complete sequence of construction by activity.
 2. Identification of the activity by structure, location and type of work.
 3. Chronological order of the start of each item of work.
 4. The activity start and stop dates.
 5. The activity duration.
 6. Successor and predecessor relationships for each activity. Group related activities and use lines to indicate relationships.
 7. A clearly indicated critical path. Indicate only one (1) critical path on the schedule. The subsystem with the longest time of completion is the critical path where several subsystems each have a critical path. Float time is to be assigned to other subsystems.
 8. Projected percentage of completion, based on completion milestones.
 9. Identify resources required for work activities including major equipment such as cranes, drill rigs, and stressing equipment.
 10. Identify coordination activities required by/with Owner.
 11. Identify major equipment and material procurement activities.
 12. Identify any required regulatory permits or other authorization.
- D. Submit a separate submittal schedule indicating the dates when the submittals are to be sent to the Owner's resident representative.
1. List specific dates submittal is to be sent to the Owner's Representative.
 2. List specific dates submittal must be processed in order to meet the proposed schedule.

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3. Allow a reasonable time to review submittals, taking into consideration the size and complexity of the submittal, the submission of other submittals, and other factors that may affect review time.
 4. Allow time for re-submission of the submittals for each item. Contractor is responsible for delays associated with additional time required to review incomplete or erroneous submittals and for the time lost when submittals are submitted for products that do not meet specification requirements.
- E. Update the schedule at the end of each partial payment period to indicate the progress made on the project to that date.

1.04 SCHEDULE REVISIONS

- A. Revise the schedule if it appears that the schedule no longer represents the actual progress of the work.
1. Submit a written report if the schedule indicates that the project is more than ten (10) days behind schedule. The report is to include:
 - a. The number of days behind schedule.
 - b. Narrative description of the steps to be taken to bring the project back on schedule.
 - c. Anticipated time required to bring the project back on schedule.
- B. Revise the schedule to indicate any adjustments in contract time approved by change order.
1. Revised schedule is to be included with Contract Modification Request and in response to Proposed Contract Modifications by the Owner for which an extension of time is requested.
 2. Failure to submit a revised schedule indicates that the modification shall have no impact on the ability of the Contractor to complete the project on time and that the cost associated with the change of additional plant, equipment, or work force have been included in the cost proposed for the modification.
- C. Updating the project schedule to reflect actual progress is not considered a revision to the project schedule.
- D. Payment estimates may not be recommended for payment without a revised schedule, and if required, the report indicating the Contractor's plan for bringing the project back on schedule.

1.05 FLOAT TIME

- A. Define float time as the amount of time between the earliest start date and the latest start date of a chain of activities on the construction schedule.

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- B. Float time is not for the exclusive use or benefit of either the Contractor or Owner.
- C. Contract time cannot be changed by the submission of this schedule. Contract time can only be modified by approved Change Order.
- D. Schedule completion date must be the same as the Contract completion date. Time between the end of construction and the Contract completion date is to be indicated as float time.

END OF SECTION

SECTION 01 40 00 - QUALITY CONTROL

PART 1: GENERAL

1.01 CONTRACTOR'S RESPONSIBILITIES

- A. Control the quality of work produced and verify that the work performed meets the standards of quality established in the Contract Documents.
1. Inspect the work performed by the Contractor, subcontractors and suppliers. Correct defective work.
 2. Inspect products to be incorporated into the project. Provide only those products that comply with the Contract Documents.
 3. Verify conformance of the work and products with the Contract Documents before notifying the Owner of need for testing.
 4. Provide consumable construction materials of adequate quality to provide a finished product that complies with the Contract Documents.
 5. Provide and pay for the services of an approved professional independent materials testing laboratory to insure that products proposed for use fully comply with the Contract Documents.
 6. Perform quality control tests as indicated in this and other sections of the specifications. Schedule the time and sequence of testing with the Owner's Resident Representative. All quality control testing is to be observed by the Owner's Resident Representative.
 7. Provide labor, materials, tools, equipment, and related items for quality control testing.
- B. Provide Certified Test Reports on products or constructed works to be incorporated into the project as required by Section 01300 – SUBMITTAL. Reports are to indicate that products or constructed works are in compliance with the Contract Documents.
- C. Provide and maintain a written Quality Control Program that establishes the methods of assuring compliance with the Contract Documents.
- D. Provide a Quality Control Manager with the authority to monitor the work effectively and to implement and enforce the Quality Control Program. Also provide an Alternate Quality Control Manager to serve in the absence of the Quality Control Manager. The Quality Control Manger and Alternate Quality Control Manager shall be persons other than the Contractor's Site Superintendent or Project Manager. No work shall take place without the Contractor's Quality Control Manager or Alternate Quality Control Manager onsite to observe and inspect the work. Substitutions of the Contractor's Quality Control staff will not be allowed without prior written approval from the Owner. Any substitution in the Contractor's Quality Control staff must meet or exceed the qualifications and experience requirements as specified in Section 00100 – INSTRUCTIONS TO BIDDERS.
- E. Assist the Engineer, Owner, and Owner's quality assurance testing organization, and Owner's Resident Representative to perform Owner's quality assurance activities.

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1. Provide access to the work and to the Manufacturer's operations at all times work is in progress.
2. Cooperate fully in the performance of sampling, inspection, and testing.
3. Furnish labor and facilities to:
 - a. Provide access to the work to be tested.
 - b. Obtain and handle samples for testing at the project site or at the source of the product to be tested.
 - c. Facilitate observations and tests.
 - d. Store and cure test samples.
4. Furnish copies of quality control tests performed on products.
5. Provide adequate quantities of representative product for Owner's quality assurance testing.
6. Give the Owner adequate notice before proceeding with work that would interfere with testing.
7. Notify the Owner's Resident Representative prior to the time that quality assurance testing is required. Lead time is to be adequate to allow arrangements to be made for testing.
8. Do not proceed with any work until Owner's quality assurance testing has been performed and results of tests indicate that the work is acceptable.
9. Provide complete access to the site and make Contract Documents available.
10. Provide personnel and equipment needed to perform sampling or to assist in making the field tests.
11. Quality assurance testing performed by the Owner will be paid for by the Owner, except for verification testing performed by the Owner, which shall be paid for by the Contractor as described in Paragraph 1.06.

F. Provide a recognized independent testing laboratory capable of performing a full range of quality control testing procedures compliant with the standards or testing procedures specified. Obtain Owner's approval for the testing laboratory before testing is performed.

G. Provide personnel certified to perform required quality control tests.

H. Should requirements of this Section of the specification conflict with the requirements of the technical specifications, the technical specifications shall govern.

1.02 QUALITY ASSURANCE ACTIVITIES BY THE OWNER

- A. Quality assurance activities of the Owner through its own forces or through contracts with materials testing laboratories and survey crews are for the purpose of monitoring the results of the Contractor's completed work to determine if it is in compliance with the requirements of the Contract Documents.
1. Quality assurance activities of the Owner, Engineer, and Owner's Representative in no way relieves the Contractor of the obligation to perform work and furnish products and constructed work conforming to the Contract Documents.

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2. Failure on the part of the Owner or Engineer to conduct quality assurance observations or quality assurance testing in no way relieves the Contractor of the obligation to perform work and furnish materials conforming to the Contract Documents.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01300 – SUBMITTAL, and shall include:

1. The name of the proposed quality control testing laboratory along with documentation of qualifications, a list of tests that can be performed, and a list of recent projects for which testing has been performed with references from those projects.
2. Written Quality Control Program.
3. Submit for approval the name and resume of Contractor's Quality Control Manager and the Alternate Quality Control Manager.
4. Test reports.

1.04 STANDARDS

- A. Provide a quality control testing laboratory that complies with the ACIL (American Council of Independent Laboratories) "Recommended Requirements for Independent Laboratory Qualifications".
- B. Perform testing per recognized test procedures as listed in the various sections of the specifications, standards of the State Department of Highways and Public Transportation, American Society of Testing Materials (ASTM), or other testing associations. Perform tests in accordance with published procedures for testing issued by these organizations.

1.05 DELIVERY AND STORAGE

Handle and protect test specimens of products and construction materials at the Construction site in accordance with recognized test procedures.

1.06 VERIFICATION TESTING

- A. Provide verification testing or pay for Owner's verification testing in a Change Order when quality assurance tests performed by the Owner indicate that materials or the results of construction activities are not in conformance with Contract Documents.
- B. Verification testing shall be performed at the Contractor's expense to verify products or constructed works are in compliance after corrections have been made.
- C. Tests shall comply with recognized methods or with methods recommended by the Owner's testing laboratory and approved by the Owner's Resident Representative.

1.07 TEST REPORTS

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- A. Test reports shall be prepared for all tests.
1. Tests performed by testing laboratories shall be submitted on standard test report forms. These reports must include the following:
 - a. Name of the Owner, project title and number, equipment installer and general contractor.
 - b. Name of the laboratory, address, and telephone number.
 - c. Name and signature of the laboratory personnel performing the test.
 - d. Description of the product being sampled or tested.
 - e. Date and time of sampling, inspection, and testing.
 - f. Date the report was issued.
 - g. Description of the test performed.
 - h. Weather conditions and temperature at time of test or sampling.
 - i. Location at the site or structure where the test was taken.
 - j. Standard or test procedure used in making the test.
 - k. A description of the results of the test.
 1. Statement of compliance or non-compliance with the Contract Documents.
 - m. Interpretations of test results, if appropriate.
 2. Submit reports on tests performed by Contractor or his suppliers or vendors on the approved forms.
 3. Owner will prepare quality assurance test reports with results of tests performed by the Owner.
- B. Distribute four (4) copies of the test reports to the Owner's Resident Representative within 24 hours of completing the test.

1.08 NON-CONFORMING WORK

- A. Immediately correct any work that is not in compliance with the Contract Documents or submit a written explanation in of why the work is not to be corrected immediately and when the corrective work will be performed.
- B. Payment for non-conforming work shall be withheld until work is brought into compliance with the Contract Documents.
- C. Payment for Owner's verification testing and for Owner's review of non-conforming work shall be by Contractor in a Change Order.

1.09 LIMITATION OF AUTHORITY OF THE OWNER'S TESTING LABORATORY

- A. The Owner's testing laboratory representatives are limited to providing consultation on the test performed, and in an advisory capacity.
- B. The Owner's testing laboratory is not authorized to:
 1. Alter the requirements of the contract documents.

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2. Accept or reject any portion of the work.
3. Perform any of the duties of the Contractor.
4. Stop the work.

PART 2 PRODUCTS

2.01 TESTING APPARATUS

- A. Furnish testing apparatus and related accessories necessary to perform quality control tests.
- B. Furnish testing apparatus, materials, and testing processes that comply with Section 01014 ENVIRONMENTAL PROTECTION REQUIREMENTS.

PART 3 EXECUTION

Perform quality control observations and testing as required in each section of these specifications.

END OF SECTION

SECTION 01 51 00 - TEMPORARY FACILITIES

PART 1: GENERAL

1.01 WORK INCLUDED

- A. Furnish temporary facilities, including Contractor's and Owner's field offices, storage sheds, sanitary facilities, temporary utilities, and temporary security fencing and gates needed to complete the work.
- B. Furnish, install, and maintain temporary project identification signs. Provide temporary on-site informational signs to identify key elements of the construction facilities. Do not allow other signs to be displayed.
- C. Contractor shall provide potable water and electrical and telephone service connections to Owner's Resident Representative temporary facilities and Contractor's temporary facilities.
- D. Contractor shall provide security for Owner's Resident Representative's temporary facilities.

1.02 SUBMITTALS

Submittals shall be in accordance with Section 01300 – SUBMITTALS, and shall include:

- A. Locations for temporary project office(s), storage buildings, materials storage areas, fences, gates, lighting, signs, and sanitation facilities.
- B. Layout of fuel and chemical storage facilities.
- C. Types of floodlights for use at night.
- D. Owner's Resident Representative's temporary facility.
- E. Project information and project identification signs layouts.
- F. Prior to installation of Owner/Engineer field office, submit the following information for approval:
 - 1. Office Trailer/Building — floor plan including square footage of floor area
 - 2. Telephone equipment — catalog cut sheets
 - 3. Computer equipment — catalog cut sheets
 - 4. Security/Alarm System — catalog cut sheets
 - 5. Office Furniture— catalog cut sheets

1.03 DELIVERY AND STORAGE

Arrange transportation, loading, and handling of temporary buildings and sheds.

1.04 JOB CONDITIONS

- A. Locate buildings and sheds at the job site as indicated or as approved by the Owner.
- B. Prepare the site by removing trees, brush, or debris and performing demolition or grubbing needed to clear a space adequate for structures and facilities.
- C. Pay for utilities used by temporary facilities during construction.
- D. Provide temporary services and facilities to be ready for use when they are first needed to avoid delay in the performance of the work.
- E. Maintain, expand as required, and modify temporary services and facilities as needed throughout the progress of the work.
- F. Do not remove services and facilities until no longer needed.
- G. Operate temporary facilities in a safe, efficient, and environmentally sound manner.
 - 1. Do not overload temporary services or facilities.
 - 2. Do not let temporary services or facilities interfere with the progress of the work.
 - 3. Do not allow unsanitary conditions, public nuisances, or hazardous conditions to develop or exist at the site.
 - 4. Do not permit freezing of pipes, flooding, or the contamination of water.
 - 5. Maintain site security and protection of the facilities.

1.05 OPTIONS

- A. Construction offices may be prefabricated buildings on skids or mobile trailers.
- B. Storage sheds may be prefabricated buildings on skids or truck trailers.

Part 2 PRODUCTS

2.01 SIGN MATERIALS

- A. Provide new or used, wood or metal, in sound condition for structure and framing. Materials are to be structurally adequate and suitable for the indicated finish.
- B. Provide 3/4" exterior grade A/D face veneer plywood with medium density overlay for sign surface.
- C. Bolts, brackets, fasteners, and other hardware are to be galvanized or stainless steel.
- D. Provide exterior quality coatings.

2.02 TEMPORARY STORAGE BUILDINGS

Furnish storage buildings of adequate size to store any materials or equipment delivered to the site that might be affected by weather or as recommended by the manufacturer.

2.03 TEMPORARY SANITARY FACILITIES

- A. Provide sanitary facilities at the job site from the commencement of the project to its conclusion. Sanitary facilities may be required at several locations. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority. Empty trash receptacles on a daily basis.
- B. Contractor's workmen shall use these sanitary facilities at all times. Rest rooms within existing or Owner-occupied buildings shall not be used.

2.04 TEMPORARY UTILITIES

- A. Provide all temporary utilities needed by the trades during construction, including electrical power, water, and telephone.
 - 1. Provide a source of temporary electrical power of adequate size for the construction procedures.
 - a. 480V(34)/60A electrical service is available outside the powerhouse.
 - b. Provide a minimum of 208V/100A electrical service at the primary staging area for the Owner's and Contractor's offices.
 - c. Contractor shall provide all cabling, accessories, panels, and other appurtenances necessary to connect to existing service.
 - d. Electrical pole and service shall comply with OSHA and other safety requirements and the requirements of the power company.
 - e. Make electrical power available to the trades as needed.
 - f. Provide extensions to the various parts of the project site as needed.
 - 2. Provide a temporary source of potable and non-potable water for use during construction. Water may be pumped from the lakes as needed for construction purposes; however, water levels and water quality will fluctuate.
 - 3. Arrange for and provide temporary phone service for the Owner's and Contractor's offices.
- B. Make arrangements with the local utility company, comply with utility company's requirements and pay for the utility costs during construction.
- C. Make utilities available to the trades during construction.

PART 3 EXECUTION

3.01 LOCATION OF TEMPORARY FACILITIES

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- A. Locate all temporary facilities in the staging area as shown on the drawings in an area that will not interfere with any work to be performed under this contract and will allow ready access by personnel.
- B. Construct and install signs at locations as required by applicable regulatory agencies or as selected by the Owner. Install informational signs at the height of optimum visibility, on ground-mounted poles, or attach to temporary structural surfaces.

3.02 PROJECT IDENTIFICATION AND SIGNS

- A. Arrange for a professional sign painter to paint a sign as specified herein. Mount sign at construction entrance at a place selected by the Owner's Resident Representative. Maintain this sign until the project has been completed.
- B. Paint sign on overlay side of the plywood board. Frame plywood board in a channel routed $\frac{1}{2}$ " deep into a 2 x 4 frame. Shoulder, glue, and screw corners and mount on not less than two (2) 4 x 4 posts.
- C. Do not install any other signs at the construction site, except as specified herein. Contractors may install a sign not greater than 48" x 36" on the side of their construction office, or the side of the office or trailer may have the company's name or identification permanently and neatly applied.

D. TEMPORARY SIGNS

1. INFORMATIONAL SIGNS

- a. Provide one (1) project information sign of the size, lettering, and construction indicated by the Owner.
- b. Apply one (1) coat of primer and one (1) coat of exterior paint to exposed supports, framing, and sign surface material. Paint graphics in styles, sizes, and colors selected by the Owner.
- c. Content of the information shall be as approved by the Owner in writing.
- d. Provide one sign at each entrance off Lake Austin Boulevard Red Bud Trail, and one sign at the temporary offices to require all site visitors to sign in.

2. PROJECT IDENTIFICATION SIGNS

- a. Provide one (1) project identification sign of the size, lettering, and construction indicated by the Owner.
- b. Apply one (1) coat of primer and one (1) coat of exterior paint to exposed supports, framing, and sign surface material. Paint graphics in styles, sizes, and colors selected by the Owner.

3. WARNING SIGNS per DOT, TCEQ, and OSHA requirements.

- E. Maintain signs and supports in a neat, clean condition. Repair damages to structures, framing, or signs.

3.03 ERECTION OF RESIDENT ENGINEER'S OFFICE BUILDING [NOT USED]

3.04 TEMPORARY LIGHTING

- A. Provide temporary lighting for Contractor's use.
 - 1. Temporary lights shall be removed once the permanent work is completed.
- B. Provide portable flood lights at any time that work will be performed at night. Provide adequate lighting to provide sufficient light at any location work is being performed.
- C. Temporary outdoor lighting shall be provided for safety and personal security, as deemed necessary by the Contractor, within the limits of construction, where there is outdoor work activity during hours of darkness. Glare and light trespass control shall be provided to protect local inhabitants from the consequences of stray light shining onto neighboring properties. Light pollution control shall be provided to minimize the negative effect of misdirected upward light.
- D. All temporary outdoor lighting shall be turned off between 9 p.m. and sunrise, with the exception that temporary construction office building and staging area security lighting may remain on at all times.
- E. Temporary outdoor lighting systems shall be installed, operated and maintained in conformance with the National Electric Code and applicable building code of the City of Austin, Texas.
- F. Ground mounted and portable temporary flood lighting shall illuminate only the work area.
- G. Temporary luminaries shall be fully shielded with full cut-off with the exception of sources less than 1800 lumens. Fully shielded luminaries shall have a cut-off angle of no more than eighty (80°) degrees, as measured from the nadir.
- H. Temporary pole or building mounted luminaries shall not exceed 18 feet in height (including base), as measured from the adjacent grade to the top of the fixture.
- I. Temporary outdoor lighting systems shall not produce unwanted light onto adjacent property as measured from the property line. Employ full cut-off, shielding, appropriate aiming, mounting height as needed to prevent light trespass. Under no circumstance shall the illumination crossing the property boundary line be greater than 0.05 foot candles, as measured at the adjacent property line.

3.05 DRINKING WATER

Contractor shall provide potable water for Contractor's use. No potable water is available on the project site or at the staging area.

3.06 CONSTRUCTION FENCE

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Install and maintain construction fences and gates at locations indicated on drawings and as Contractor deems necessary for security and safety purposes. Owner's existing fences may be used, but Contractor shall be solely responsible for reliance upon Owner's fences and gates for security purposes. Submit temporary construction fence layouts and modifications to Owner's fences to Owner's Resident Representative after Notice to Proceed at not later than seven (7) calendar days prior to delivery of fence materials or start of fence installation.

3.07 REMOVAL OF TEMPORARY FACILITIES

- A. Remove temporary buildings, shed, and utilities at the conclusion of the project and restore the site to original condition in accordance with the drawings.
- B. Remove informational signs upon completion of construction.
- C. Remove project identification signs, framing, supports, and foundations upon completion of the project.

END OF SECTION

SECTION 01 70 00 - CONTRACTOR CLOSEOUT

PART 1: GENERAL

1.01 WORK INCLUDED

Comply with requirements of the General Conditions and specified administrative procedures in closing out the Construction Contract.

1.02 SUBMITTALS

- A. Submit Written notification that the work or designated portion of the work is substantially complete to the Owner's Resident Representative when the work is considered to be substantially complete per the General Conditions. Include a list of the items remaining to be completed or corrected before the project will be considered to be complete.
- B. Owner and Engineer will visit the project site to observe the work within a reasonable time after notification is received to determine the status of completion. Owner's Environmental and Safety Office will participate in the site visit to verify that the completion and closeout of the project is in compliance with the requirements of the USACE Nationwide Permit.
- C. Owner will issue notification that the work is either substantially complete or that additional work must be performed before the project may be considered substantially complete.
 - 1. Owner will notify in writing of items that must be completed before the project can be considered substantially complete.
 - a. Correct the noted deficiencies in the work.
 - b. Issue a second written notice with a revised list of deficiencies when work has been complete.
 - c. Owner and Engineer shall revisit the site and the procedure shall begin again.
 - 2. Engineer will issue a tentative Certificate of Substantial Completion when the project is considered to be substantially complete. Certificate will include a tentative list of items to be corrected before final payment.
 - a. Owner will review and revise the list of items and notify the Engineer of any objections or other items that are to be included in the list.
 - b. Engineer will prepare a definite Certificate of Substantial Completion with a revised tentative list of items to be corrected or completed.

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- c. Review the list and notify the Owner's Representative in writing of any objections within ten (10) days of receipt of Certificate of Substantial Completion.

1.04 FINAL COMPLETION

- A. Submit written certification of completion on the approved form when the project is complete and:
 1. Contract Documents have been reviewed.
 2. Work has been completed in compliance with the Contract Documents.
 3. Equipment and systems have been tested per Contract Documents and are fully operational.
 4. Final Operations and Maintenance Manuals have been provided to the Owner and all operator training has been completed.
 5. Specified spare parts and special tools have been provided.
 6. Work is complete and ready for final inspection.
 7. Final cleaning is complete in accordance with Section 01710 – FINAL CLEANING.
 8. Written certification has been provided that temporary access has been returned to pre-existing conditions.

- B. Owner and Engineer will make a site observation with the appropriate regulatory agencies to determine the status of completeness within a reasonable time after the receipt of the Certificate. Owner's Environmental and Safety Office will participate in the inspection to verify that the completion is in compliance with the requirements of the USACE Nationwide Permit.

- C. Owner will issue notice that the project is complete or notify the Contractor that work is not complete or is defective.
 1. Submit the request for final payment with Closeout submittals described in Paragraph 1.07 if notified that the project is complete and the work is acceptable.
 2. Upon receipt of notification that work is incomplete or defective, take immediate steps to remedy the stated deficiencies. Send a second certification to the Owner's Representative when work has been completed or corrected.
 3. Owner and Engineer will re-visit the site and the procedure will begin again.

1.05 CLOSEOUT SUBMITTALS

- A. Record Drawings per Section 01040 – PROJECT ADMINISTRATION.

- B. Warranties and bonds.

- C. Evidence of payment or release of liens on approved forms and as required by the General Conditions.

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- D. Consent from Surety to Final Payment.
- E. Equipment installation reports on anchors, equipment, and/or instrumentation.
- F. Shop drawings, record data, Operations and Maintenance Manuals, and other submittals as required by the Contract Documents.
- G. Specified spare parts and special tools.
- H. Certificates of Occupancy, operating certificates, or other similar releases required to allow the Owner unrestricted use of the work and access to services and utilities.
- I. Evidence of final, continuing insurance, and bond coverage as required by the Contract Documents.
- J. Provide written certification that work has been performed according to the requirements of the USACE Nationwide Permit.

1.06 FINAL PAYMENT REQUEST

- A. Submit a preliminary final payment request. This request is to include adjustments to the Contract Amount for:
 - 1. Approved Change Orders
 - 2. Allowances not previously adjusted by Change Order
 - 3. Unit prices
 - 4. Deductions for defective work that has been accepted by the Owner
 - 5. Penalties and bonuses
 - 6. Deductions for liquidated damages
 - 7. Other adjustments
- B. Owner will prepare a final Change Order, reflecting the approved adjustments to the contract amount which have not been covered by previously approved Change Orders.
- C. Submit the final application for payment per the General Conditions, including the final Change Order.

1.07 TRANSFER OF UTILITIES [NOT USED]

1.08 WARRANTIES, BONDS, AND SERVICES AGREEMENTS

- A. Provide warranties, bonds, and service agreements required by Section 01300 – SUBMITTALS or by the individual sections of the specifications.
- B. The date for the start of warranties, bonds, and service agreements is established per the General Conditions.

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C. Compile warranties, bonds, and service agreements and review these documents for compliance with the Contract Documents.

1. Each document is to be signed by the respective manufacturer, supplier, and subcontractor.
2. Each document is to include:
 - a. The product or work item description
 - b. The firm, with the name of the principal, address, and telephone number
 - c. Scope of warranty, bond or services agreement
 - d. Date, duration, and expiration date for each warranty bond and service agreement
 - e. Procedures to be followed in the event of a failure
 - f. Specific instances that might invalidate the warranty or bond

D. Submit two (2) copies of each document to the Owner's Representative for review and transmittal to the Owner.

1. Submit duplicate sets.
2. Documents are to be submitted on 8-1/2" x 11" paper, punched for a standard three-ring binder.
3. Submit each set in a commercial quality three-ring binder with a durable and cleanable plastic cover. The title "Warranties, Bonds, and Services Agreements", the project name and the name of the Contractor are to be typed and affixed to the cover.

E. Submit warranties, bonds and services agreements:

1. At the time of final completion and before final payment.
2. Within 10 days after inspection and acceptance for equipment or components placed in service during the progress of construction.

1.10 CLAIMS AND DISPUTES

Claims and disputes must be resolved prior to recommendations of final payment in accordance with General Conditions.

END OF SECTION

SECTION 01 71 00 - FINAL CLEANING

PART 1: GENERAL

1.01 WORK INCLUDED

Perform a thorough cleaning of the site and structures prior to Final Inspection and Final Completion. Leave the project clean and ready for Owner occupancy and use.

1.02 SUBMITTALS

Submittals shall be in accordance with Section 01300 – SUBMITTALS and shall include:

- A. MSDS data sheets on products used for cleaning.

1.03 QUALITY CONTROL

Use experienced workmen or professional cleaners for final cleaning.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Furnish the labor and products needed for cleaning and finishing as recommended by the Manufacturer of the surface material being cleaned.
- B. Use cleaning products only on the surfaces recommended by the Cleaning Product Manufacturer.
- C. Use only those cleaning products which will not create hazards to health, property, or the environment and which will not damage surfaces or internal workings.

PART 3 EXECUTION

3.01 FINAL CLEANING

- A. Thoroughly clean the entire site and make ready for occupancy.
 - 1. Remove construction debris, boxes, and trash from the site and dispose at an off-site, approved, permitted, waste disposal facility.
 - 2. Remove construction storage sheds, field offices, and other temporary facilities.
 - 3. Restore grade to match surrounding condition and remove excess dirt.
 - 4. Reseed as specified those areas disturbed by construction activities.

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- B. Remove oil, grease, dust, grout, debris, metal cuttings, and other contamination from concrete surfaces.

- C. Broom clean exterior structural surfaces and rake clean other surfaces of the grounds.

END OF SECTION

SECTION 01 73 00 - OPERATION AND MAINTENANCE MANUALS

PART 1: GENERAL

1.01 WORK INCLUDED

- A. Prepare a complete and detailed Operation and Maintenance Manual for each type and model of equipment or product furnished and installed under this contract.
- B. Prepare the manuals in the form of an instruction manual for the Owner. The manual is to be suitable for use in providing operation and maintenance instruction.
- C. Provide complete and detailed information specifically for the products or systems provided for this project. Include the information required to operate and maintain the product or system.
- D. Manuals are to be in addition to any information packed with or attached to the product when delivered. This information is to be taken from the product and provided as an attachment to the manual.

1.02 SUBMITTALS

Submit manuals in accordance with Section 01300, SUBMITTALS. Attach to each manual a copy of the approved Operation and Maintenance Manual Review Form, with pertinent information completed.

1.03 GUARANTEES

Provide copies of the Manufacturer's warranties, guarantees, or service agreements in accordance with Section 01700 – CONTRACT CLOSEOUT.

2.00 PRODUCTS

2.01 MATERIALS

- A. Print manuals on heavy, first quality paper.
 - 1. Paper shall be 8-1/2" X 11" paper.
 - a. Reduce drawings and diagrams to 8-1/2" X 11" paper size.
 - b. When reduction is not practical, fold drawings and place each separately in a clear, super heavy weight, top loading polypropylene sheet protector designed , for ring binder use. Provide a typed identification label on each sheet protector.

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2. Punch paper for standard three-ring binders.

B. Place manuals in Wilson Jones 385 Line D-Ring DUBLLOCK Presentation Binders.

1. Binders are to have clear front, back, and spine covers.
2. Sheet lifters are to be provided.
3. Minimum size is 2" capacity. Maximum size is 3" capacity. Provide multiple binders as necessary.

C. Provide tab indexes for each section of the manual.

1. Indexes are to be constructed of heavy-duty paper with a reinforced binding edge and punched with 9/32" holes to fit the binders.
2. Index is to have clear insertable tabs or may have clear tabs for a typed insert.

PART 3 EXECUTION

3.01 MANUAL ORGANIZATION AND CONTENTS

A. Provide a Table of Contents listing each section of the manual for each product or system.

1. Identify each product or system using the nomenclature shown in the Contract Documents.
2. Assign a number and letter to each section in the manual.
 - a. Assign a number to each product or system. The number is to correspond to the Owner's equipment numbering system or other system designated by the Owner.
 - b. A cross reference is to be provided for the Owner's numbering system and designations for equipment indicated in the Contract Documents.
 - c. The letter assigned will represent the part of the manual, consistent with the manual contents as required by Paragraphs 3.02 and 3.03.
3. Provide index tabs for each section in the manual.
4. The designation on each index tab is to correspond to the number and letter assigned in the Table of Contents.

B. Include only the information that pertains to the product described. Annotate each sheet to:

1. Clearly identify the specific product or component installed.
2. Clearly identify the data applicable to the installation.
3. Delete reference to inapplicable information.

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- C. Supplement manual information with drawings as necessary to clearly illustrate relations of component parts of equipment and systems, and control and flow diagrams.
- D. Identify each manual by placing a printed cover sheet in the front cover of the binder and as the first page in the manual. The first page is to be placed in a clear sheet protector. The information on the first page and the cover page are to include:
 - 1. Name of Owner
 - 2. Project Name
 - 3. Volume Number
 - 4. The Table of Contents for that Volume
- E. Insert the Table of Contents into the spine of each manual.
- F. Manuals for several products or systems may be provided in the same binder.
- G. Correlate the data into related groups when multiple binders are used.
- H. Fill binders to only $\frac{3}{4}$ of its indicated capacity to allow for addition of materials to each binder by the Owner.

3.02 EQUIPMENT AND SYSTEMS MANUAL CONTENT

Manual shall provide the following information:

- A. A description of the unit and component parts.
- B. Operating instructions for startup, normal operations, regulation, control, shutdown, emergency conditions, and limiting operating conditions.
- C. Maintenance instructions including assembly, installation, alignment, adjustment, and checking instructions.
- D. Lubrication schedule and lubrication procedures.
- E. Troubleshooting guide.
- F. Schedule of routine maintenance requirements
- G. Description of sequence of operation by the Control Manufacturer.
- H. Warnings for detrimental maintenance practices.

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- I. Parts lists including:
 - 1. Part numbers for ordering new parts
 - 2. Assembly illustrations showing an exploded view of the complex parts of the product
 - 3. Predicted life of parts subject to wear
 - 4. List of the Manufacturer's recommended spare parts, current prices with effective date and number of parts recommended for storage
 - 5. Directory of a local source of supply for parts with company name, address, and telephone number
 - 6. Complete nomenclature and list of commercial replacement parts
- J. Outline, cross section and assembly drawings, engineering data, test data, and performance curves.
- K. Control schematics and point to point wiring diagrams prepared for field installation, including circuit directories of panel boards and terminal strips.
- L. Other information as may be required by the individual sections of the specifications.

3.03 LIST OF SERVICE ORGANIZATIONS

Provide a directory of authorized service organizations with company name, address, telephone number, and the contact person for warranty repair and for technical support.

END OF SECTION

SECTION 02 20 10 - DEMOLITIONS, REMOVALS AND ALTERATIONS

PART 1: GENERAL

1.01 EXTENT

- A. The intent of this specification is to define the requirements for demolition, removal, and alteration Work of existing construction.
- B. The Work shall include, but not be limited to, the following items:
 - 1) Demolition, removal or alteration Work as specified on the Design Drawings.
 - 2) Use of reusable materials as specified on the Design Drawings.
 - 3) Offsite Disposal of Waste to EPA approved site.
 - 4) Cleanup.
- C. Definitions
 - 1) Demolition: Demolition shall mean existing construction, equipment, structural steel, etc., indicated to be removed shall be removed in its entirety to the indicated or established points of termination and to the extent necessary for the proper execution of new Work.
 - 2) Removal: Removal shall mean removal of that existing construction, equipment, steel members, etc., as specified in a manner that will not damage the removed material or equipment, and to reinstall removed construction at the appropriate time or store same on the plant property as directed by LCRA.
 - 3) Alteration: Alteration shall mean the careful removal, reworking, and/or modifying of construction left in-place to be secure and to accept correction to new construction.

1.02 REFERENCE DOCUMENTS

- A. Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state or local codes having jurisdiction.
- B. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

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- C. Abbreviations listed indicate the form used to identify the reference documents in the Specification text.
- D. ANSI - American National Standards Institute/NSC — National Safety Council
 - 1) ANSI A10.11 — Construction and Demolition Operations - Safety Requirements for Personnel and Debris Nets. ANSI A10.13 - Construction and Demolition Operations - Safety Requirements for Steel Erection.
 - 2) ANSI A10.14/NSC A10.14 - Construction and Demolition Operations - Requirements for Safety Belts, Harnesses, Lanyards, and Lifelines.
 - 3) ANSI A10.18/NSC A10.18 - Construction and Demolition Operations — Temporary Floor and Wall Openings, Flat roofs, Stairs, Railings, and Toeboards — Safety Requirements.
 - 4) ANSI A10.28/NSC A10.28 - Safety Requirements for Work Platforms Suspended from Cranes and Derricks for Construction and Demolition Operations.
 - 5) ANSI A10.33/NSC A10.33 - Construction and Demolition Operations — Safety and Health Program Requirements for Multi-Employer Projects.
 - 6) ANSI A10.6/NSC A10.6 — Safety Requirements for Demolition.
 - 7) ANSI A10.9/NSC A10.9 - Construction and Demolition Operations — Concrete and Masonry Work.

1.03 SUBMITTALS

- A. None required.

1.04 QUALITY ASSURANCE

- A. Inspection before working: The Contractor shall examine the areas and conditions under which demolition, removal, or alterations, are to take place and notify LCRA in writing of conditions which are detrimental to the proper and timely completion of the Work.
- B. Demolition, removal or alteration procedures and Work are subject to inspections conducted by LCRA. Such inspections shall not relieve the Contractor of the responsibility of providing Work in compliance with the specification. LCRA reserves the right, at any time before final acceptance, to reject Work not complying with the specified requirements.

1.05 DATA ON EXISTING CONDITIONS

- A. Details of existing construction to be removed, altered, reused, etc., are furnished for Contractor's convenience; in using them, Contractor assumes the risk as LCRA

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assumes no responsibility for accuracy of details. Contractor will be permitted to make its own investigation of details, etc., during the Project Site visit during the Bid Period.

- B. The Drawings (Design and Demolition) may not indicate all demolition, removal and alterations required to accept new construction indicated on the Design Drawings. The Contractor shall be responsible for minor demolition and alteration Work as is required to install new construction/equipment.

1.06 CONDITIONS

- A. No sale of salvage material shall be conducted on-site. Burning of debris shall not be permitted.
- B. Care shall be exercised by the Contractor to ensure no disruption of service occurs to adjacent facilities to remain in service and no debris is deposited in areas not specifically approved by LCRA. Contractor shall handle debris in a safe manner as required to meet LCRA's onsite requirements and all applicable codes. Contractor shall provide all necessary containers, carts, and dumpsters for handling debris.
- C. Trash chute(s) from elevated areas to a dumpster at grade shall be designed and provided by Contractor, or other method(s) as approved by LCRA. The design of trash chute(s) shall be performed by a professional engineer, registered in the State in which the Work is provided.

PART 2: PRODUCTS

2.01 MATERIALS

- A. Not Applicable.

PART 3: EXECUTION

3.01 DEMOLITION AND REMOVAL

- A. General
 - 1) The Work shall be performed in full compliance with the requirements of the documents referenced in Paragraph 103.D and with any other applicable requirements of Federal, State and Local governing bodies having jurisdiction.
 - 2) The Work shall be performed by skilled workers with experience in the type of demolition or removal Work to be performed.
 - 3) The Contractor shall perform demolition, removal and specified alteration Work required to install/construct new foundations, etc., and to make proper connections of new construction to in-place construction.

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- 4) Existing exterior barrier materials (roofing, siding, etc.) shall not be removed without adequate protection from inclement weather. The method and material used for protection shall be acceptable to LCRA. Work (new or existing) that is damaged by moisture due to the failure of the Contractor to provide protection shall be removed and replaced by the Contractor at no cost to LCRA.
- 5) The Contractor shall perform required cutting, removal and disposal of demolished materials, and furnish and maintain necessary temporary shoring, bracing, and protection of existing Work affected by demolition and removals.
- 6) The Design Drawings may indicate certain portions of existing construction to be altered and/or removed and reused. For existing construction to be reused, carefully remove, store (if required) where requested or approved, adequately protect as approved, repair as required to put in first-class condition satisfactory to LCRA in every respect, and re-erect or re-install where and when indicated.
- 7) The Contractor shall perform demolition and removal in a neat and skillful manner, carefully terminating demolition at Work to remain in place. Special precautions shall be taken not to damage or deface Work to remain in place. The Contractor shall be responsible for any such damage and the repair thereof.
- 8) For demolition of exposed surfaces (surfaces exposed on completion of Work) of roadwork, concrete, etc., break-out edges of areas to be removed shall first be saw cut so as to leave straight, clean breaklines at exposed surfaces.
- 9) Use of drop ball, or blasting, or dropping of heavy pieces of material or equipment, IS NOT PERMITTED.
- 10) Where concrete is being demolished, the Contractor shall use water sprays to keep dust from spreading into areas of the existing plant. If tarpaulins are used, they shall be fireproofed.
- 11) The plant will be in operation during demolition and alteration Work. If demolition and alteration Work interferes with the successful operation of the existing plant, the Work shall be performed during hours as approved or as directed by LCRA.

3.02 ASBESTOS AWARENESS

- A. The existing materials to be demolished may contain asbestos as a result of the original manufacturing of this product. The destruction of this material may cause the release of asbestos fibers in excess of exposure levels contained in the Federal Clean Air Act, the Federal Occupational Safety and Health Act, and other applicable standards.

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- B. Contractor shall comply with all applicable federal, state, and local regulations including LCRA's requirements concerning the removal and disposal of asbestos containing material in accordance with LCRA's procedures and instructions for Asbestos Abatement.
- C. Contractor shall take appropriate precautions in the removal, abatement, disposal, and handling of asbestos containing materials. Handling, abatement, and disposal of asbestos must be in strict accordance with all local, state, and federal regulations and codes.
- D. It is understood and agreed that the handling or removal of asbestos products involves certain health risks, which require specific measures. LCRA shall not be responsible for safety and safety measures on the job, including measures for the protection of employees of the Contractor, subcontractor, or LCRA, nor for protection of the general public. Such responsibility for safety and safety measures is, and shall remain, that of Contractor. Contractor is solely responsible for the means and method of removing, handling, and disposing of any asbestos material. Therefore, except for claims and damages arising from the negligent acts, errors, or omissions of LCRA, Contractor agrees to hold harmless, defend, and indemnify LCRA from all claims, suits, expenses, or damages, including attorneys' fees, arising from, or alleged to arise from, exposure to or inhalation of asbestos or asbestos fibers. The negligence of LCRA shall not bar recovery by the other against the Contractor hereunder.
- E. Nothing in this agreement or contract shall impose liability on LCRA for claims, losses, expenses, or damages arising from, or in any manner related to, the exposure to, or the handling of, or disposal of asbestos, asbestos products or hazardous waste in any way of its various forms.

3.03 CONTROL AND CHARGE OF CONSTRUCTION

- A. Except as LCRA may otherwise direct, Contractor shall be solely responsible for, and shall have control and charge of construction means, methods, techniques, sequences, and procedures, and for safety precautions and programs in connection with the Work, and shall carry out the Work in accordance with the Contract Documents.
- B. LCRA shall not be responsible for, nor have control or charge over the acts or omissions of Contractor, its subcontractors, or any of their agents or employees, or any other persons performing any work relating to the Work.

3.04 CLEANUP AND DISPOSAL

- A. All waste debris and excess materials from disposal, removal, or alteration operations shall be disposed of in an offsite disposal area approved by EPA. Accumulation of such materials on the project site shall not be permitted.

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- B. The Contractor shall backfill excavations, which are part of the demolition operation, with compacted backfill in accordance with Section 312316 "Excavation and Backfill for Foundations."

END OF SECTION 02200

SECTION 02 27 00 - SOIL EROSION AND SEDIMENT CONTROL

PART 1: GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Soil erosion and sediment control.

- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 – General Requirements

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Erosion control standards: “Standards and Specifications for Soil Erosion and Sediment Control in Developing Areas” by the U.S. Department of Agriculture, Soil Conservation Service, College Park, Maryland.

PART 2: PRODUCTS

2.01 MATERIALS

- A. Straw bales, Twine tied.

- B. Pipe Riser and Barrel: 16 GA corrugated metal pipe (CMP) of size indicated.

- C. Stone for Stone Filter: 2 IN graded gravel or crushed stone.

- D. Grass Seed: Annual ryegrass.

PART 3: EXECUTION

3.01 SITE PREPARATION

- A. Prior to General Stripping Topsoil and Excavating:
 - 1. Install perimeter dikes and swales.
 - 2. Excavate and shape sediment basins and traps.
 - 3. Construct pipe spillways and install stone filter where required.
 - 4. Machine compact all berms, dikes and embankments for basins and traps.
 - 5. Install straw bales where indicated.
 - a. Provide two stakes per bale.
 - b. First stake angled toward previously installed bale to keep ends tight against each other.

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- B. Construct sediment traps where indicated on Drawings during rough grading as grading progresses.
- C. Temporarily seed basin slopes and topsoil stockpiles:
 - 1. Rate: ½ LB/1000 SF
 - 2. Reseed as required until good stand of grass is achieved.

3.02 DURING CONSTRUCTION PERIOD

- A. Maintain Basins, Dikes, Traps, Stone Filters, Straw Bales, Etc.:
 - 1. Inspect regularly especially after rainstorms.
 - 2. Repair or replace damaged or missing items.
- B. After rough grading, sow temporary grass cover over all exposed earth areas not draining into sediment basin or trap.
- C. Construct inlets as soon as possible.
 - 1. Excavate and tightly secure straw bales completely around inlets as detailed on Drawings.
- D. Provide necessary swales and dikes to direct all water towards and into sediment basins and traps.
- E. Do not disturb existing vegetation (grass and trees).
- F. Excavate sediment out of basins and traps when capacity has been reduced by 50 percent.
 - 1. Remove sediment from behind bales to prevent overtopping.
- G. Topsoil and Fine Grade Slopes and Swales, Tec.:
 - 1. Seed and mulch as soon as areas become ready.

3.03 NEAR COMPLETION OF CONSTRUCTION

- A. Eliminate basins, dikes, traps, etc.
- B. Grade to finished or existing grades.
- C. Fine grade all remaining earth areas, then seed and mulch.

END OF SECTION 02270

SECTION 02 48 00 - SITE RESTORATION

PART 1: DESCRIPTION

1.01 SCOPE OF WORK

- A. The work under this Section of the Specifications consists of furnishing all supervision, labor, equipment, material to repair/replace pavement, curb and gutter, driveways, install grass for ground cover, walkways, and permanent erosion control of the jobsite.
- B. Revegetation shall be a continual process during the construction and will immediately follow completion of construction and testing of each section in conformance with the Section 01014 – Environmental Protection, and Section 01550 – Public Safety and Convenience.
- C. Revegetation and restoration on private property shall consist of sodding disturbed areas as appropriate and restoring any patios, walkways, rock walls, or other surface features damaged during construction to existing condition or better. Restoration of shrubs will not be required.
- D. Restoration of private property for service connections shall be completed within 5 days of completion of the connection and commencement of service.

1.02 SUBMITTALS

- A. The work under this Section of the Specifications shall be performed by or under the direct on-site supervision of an individual with proven expertise with the procedures and techniques required by these specifications. The name and qualifications of that person shall be submitted to the Architect for approval in conformance with Section 01300 - Submittals.

PART 2: PRODUCTS

2.01 SEED MIX

Houston Toad

This project is located in the Utilities Houston Toad permit area. The Houston toad is a federally-listed endangered species. The breeding season for the Houston toad is January 1 through June 30.

- Construction shall occur outside the breeding season for the Houston toad.
- If mowing equipment is needed for clearing grass, forbs and small-diameter woody vegetation the blades must be set at a height of at least 5 inches above the ground to minimize the potential for striking toads.
- All disturbed areas shall be returned to approximate pre-construction contours where possible.

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- Large disturbed areas shall be seeded with native, non-sod-forming species. Southeast Recovery Mix from Native American Seed shall be used if revegetation efforts are required.
- Imported topsoil shall be used only in areas disturbed to the point that the use of topsoil local to the site is not practical. Imported topsoil will be inspected for evidence of fire ants. Any imported topsoil found to contain fire ants or their eggs shall be treated prior to use.
- Gasoline and diesel fueled equipment shall be inspected for signs of fuel or hydraulic leak.
- All hazardous materials related to construction activities shall be properly contained, used and /or disposed of properly.

PART 3: EXECUTION

3.01 GROUND PREPARATION AND RESTORATION METHOD

- A. Immediately following completion of construction and in accordance with Section 01014 - Protection of the Environment, excess spoil and debris shall be removed and the construction area shall be graded to the original or specified contours as shown on construction plans. The surface of the ground should be smooth with no rocks larger than 1", stumps, or other debris. Topsoil clay loam with P.I. of 15-40 and free of tree roots, rocks greater than 1 inch in diameter and other debris shall then be uniformly spread over all disturbed areas to a minimum depth of 4 inches. If topsoil is not available on site, it shall be imported and spread over the entire disturbed area.
- B. The seedbed shall be cultivated and rolled sufficiently to reduce the soil to a state of good tilth, when the soil particles on the surface are small enough and lie closely enough together to prevent the seed from being covered too deeply for optimum germination. The optimum depth for seeding shall be 1/4 inch (6 millimeters). Water shall be gently applied as required to prepare the seedbed prior to the planting operation either by broadcast seeding or hydraulic planting. Seeding shall be performed in accordance with the requirements hereinafter described.
- C. Natural areas consisting of native plants, trees, shrubs, and ground cover shall be seeded per this specification; lawns and grassed areas shall be sodded and shall match existing.

3.02 SEEDING AND MULCHING OR MATTING

- A. Reseeding shall immediately follow topsoiling with the mixture of grasses and rates of application as specified in the Plans. Seed shall be broadcast evenly over the topsoiled areas by hand or mechanical broadcaster. Mulching shall immediately follow seed application.
- B. Mulching shall be as specified in the Plans. Small brush or tree limbs which are removed during construction may also be passed through a shredder and spread evenly over the ground. Large concentrated accumulations should be avoided.
- C. Seeding along creeks and channels shall be accomplished by stapling in place a geotextile erosion control fabric at disturbed areas followed by seeding. If seeding

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is lost due to stream flows the Contractor shall reseed at his own expense. Multiple stream flow occurrences may be possible.

3.03 SODDING

- A. The sod shall be placed on the prepared surface with the edges in close contact and alternate courses staggered. In ditches the sod shall be placed with the longer dimension perpendicular to the flow of water in the ditch. On slopes, starting at the bottom of the slope, the sod shall be placed with the longer dimension parallel to the contours of the ground. The exposed edges of sod shall be buried flush with the adjacent soil.

3.04 MAINTENANCE AND WATERING

- A. The CONTRACTOR shall maintain and water the seeded area as necessary to establish acceptable ground coverage.
- B. The seeded areas shall be irrigated or sprinkled in a manner that will not erode the topsoil, at 10-day intervals during the first two months following planting at a rate of 13,500 gallons per acre spread uniformly over entire disturbed area. Rainfall occurrences of one-half inch or greater shall postpone the watering schedule ten (10) days.
- C. Revegetation shall be acceptable when the grass has grown at least 1 1/2" high with 70% coverage and no bare spots larger than 16 square feet exist.

3.05 STREET, DRIVEWAY AND CURB AND GUTTER

- A. CONTRACTOR shall repair or replace all asphalt/concrete paving and curb and gutter damaged as a result of construction activity. Including damage caused by equipment tracks. Damaged asphalt and concrete shall be saw cut to a clean edge and removed prior to repairing.

3.06 WALKWAYS

- A. Contractor shall replace any walkways damaged during construction. Replacement shall be to the nearest expansion/construction joint or to the limits approved by the owner's representative. Materials, finish and workmanship shall be equal to or better than existing conditions.

PART 4: MEASUREMENT AND PAYMENT

- A. Restoration and revegetation will be measured by the acre. Payment will be included in the bid item "Restoration and Revegetation" for each applicable wastewater main. No separate payment will be made for restoration & revegetation associated with connections; include in connection lump sum.

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END OF SECTION 02480

SECTION 02 64 10 - STABILIZED CONSTRUCTION ENTRANCE

PART 1: DESCRIPTION

- A. This item involves constructing a stabilized pad of crushed stone located at any point where traffic will be entering or leaving a construction site to or from a street, sidewalk or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking or deposition of sediment onto public right of way.

PART 2: MATERIALS

- A. Aggregate for construction shall conform to the following gradation:

Table 1		
Aggregate Gradation Chart (TEX 401-A, Percent Retained)		
8 inch	5 inch	2 inch
0	90-100	100

PART 3: CONSTRUCTION METHODS

- A. All trees, brush, stumps, obstructions and other objectionable material shall be removed and disposed of so as not to interfere with the excavation and construction of the entrance as indicated. The entrance shall not drain onto the public right-of-way or leave the construction site.
- B. When necessary, vehicle wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, boards, silt fence or other approved methods.
- C. The entrance shall be maintained in a condition which will prevent tracking or disposition of sediment onto public right-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public right-of-way must be removed immediately.

PART 4: MEASUREMENT AND PAYMENT

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- A. Acceptable work performed as prescribed in this item will be measured by the number of each stabilized construction entrance installed. The work and materials prescribed herein will be included in the per each bid price for construction entrance.

END OF SECTION 02641

SECTION 02 64 20 - SILT FENCE

PART 1: DESCRIPTION

- A. This item shall consist of providing and placing a filter fabric fence including maintenance of the fence, removal of accumulated silt and removal of the fence upon completion of the project.

PART 2: MATERIALS

- A. Fabric
- 1) General: The filter fabric shall be of nonwoven polypropylene, polyethylene or polyanide thermoplastic fibers with non-ravelling edges. The fabric shall be nonbiodegradable, inert to most soil chemicals, ultraviolet resistant, unaffected by moisture or other weather conditions, and permeable to water while retaining sediment. The filter fabric shall be supplied in rolls a minimum of 36 inches wide.
 - 2) Physical Requirements: The fabric shall meet the following requirements when sampled and tested in accordance with the methods indicated.

Physical Properties	Method	Requirements
Fabric Weight (oz/sy)	TEX-616-J	4.5 minimum
Water Flow Rate: (gal/sq. ft/minute)	TEX-616-J	80 maximum
Equivalent Opening Size: US Standard sieve (number)	CW-02215, US Army Corps of Engineers	40 to 100
Mullen Burst Strength: (psi)	ASTM D 3786	300 minimum
Ultraviolet Resistance; Strength retention: (%)	ASTM D 1682	70 minimum

- B. Posts: Posts shall be painted or galvanized steel Tee or Y-posts with anchor plates, not less than 5 feet in length with a minimum weight of 1.3 pounds per foot with a minimum Brinell Hardness of 143. Hangers shall be adequate to secure fence and fabric to posts. Posts and anchor plates shall conform to ASTM A 702.
- C. Wire Fence: Wire fence shall be welded wire fabric 2x4-WI, OxWI.0.

PART 3: CONSTRUCTION METHODS

- A. The silt fence fabric shall be securely attached to the posts and the wire support fence with the bottom 12 inches of the filter material buried in a trench a minimum

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of 6 inches deep and 6 inches wide to prevent sediment from passing under the fence. When the silt fence is constructed on impervious material, a 12 inch flap of fabric shall be extended upstream from the bottom of the silt fence and weighted to limit particulate loss. No horizontal joints will be allowed in the filter fabric. Vertical joints shall be overlapped a minimum of 12 inches with the ends sewn or otherwise securely tied.

- B. The silt fence shall be a minimum of 24 inches high. Posts shall be embedded a minimum of 12 inches in the ground, placed a maximum of 8 feet apart and set on a slight angle toward the anticipated runoff source. When directed by the Engineer, posts shall be set at specified intervals to support concentrated loads.
- C. The silt fence shall be repaired, replaced, and/or relocated when necessary or as directed by the Engineer. Accumulated silt shall be removed when it reaches a depth of 6 inches.

PART 4: MEASUREMENT AND PAYMENT

- A. The work performed and the materials furnished under this item will be measured by the linear foot of "Silt Fence", complete in place.
- B. Payment for removal of silt fence in the amount of the allowance in the bid form will be made upon removal of silt fence. Silt fence may be removed upon acceptance of revegetation and authorization of owner's representative.

END OF SECTION 02642

SECTION 03 35 00 - CONCRETE FINISHING

PART 1 GENERAL

1.1 SUMMARY

- A. Provide finishing materials and operations for cast-in-place concrete.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

1.3 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Mock-Ups: Provide mock-up as required to demonstrate appearance and quality of workmanship.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cast-In-Place Concrete:
 - 1. Manufacturers: Concrete Finishes: Ashford Formula, By Curecrete;L&M Construction Chemicals;Solomon Colors;SureCrete Design Products.
 - 2. Manufacturers: Concrete Curing, Sealing and Hardening:AC•Tech, Allied Construction Technologies, Inc.;Ashford Formula, By Curecrete;L&M Construction Chemicals.
 - 3. Application: Slabs on grade.
 - 4. Application: Exterior site concrete and pads.
 - 5. Sealed Concrete Materials: Concrete hardener/densifier.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Slab Finishes: Obtain sample approval before beginning work.
 - 1. Sealed Concrete: Natural finish, slight darkening acceptable.
- B. Exposed Exterior Concrete Foundation: Parged finish
- C. Protect work with suitable covering for the duration of the construction period. Report defective work in writing.

END OF SECTION 03 35 00

SECTION 04 22 00 - CONCRETE UNIT MASONRY

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. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Steel reinforcing bars.
- B. Related Sections:
 - 1. Section 05 12 00 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural-steel frame.

1.03 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 INFORMATIONAL SUBMITTALS

- A. 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, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Reinforcing bars.

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

1.05 QUALITY ASSURANCE

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

1.06 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 designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and 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.

1.07 PROJECT 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.

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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 ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.01 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
 2. Density Classification: Normal weight.
 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.

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5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.03 MASONRY LINTELS

- A. General: Provide one of the following:
- B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.04 MORTAR AND GROUT MATERIALS

- A. Mortar Cement: ASTM C 1329.
- B. Aggregate for Mortar: ASTM C 144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- C. Aggregate for Grout: ASTM C 404.
- D. Water: Potable.

2.05 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.06 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

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2.07 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.08 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 mortar cement mortar unless otherwise indicated.
 3. For exterior masonry, use mortar cement mortar.
 4. For reinforced masonry, use 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. 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.
1. For masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type S.
- C. 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 Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, Table 1 paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 1900 psi.
 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.01 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 work.
 2. Verify that foundations are within tolerances specified.

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3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
 - C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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 the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.03 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.

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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.

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.

3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, 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-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- 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. Build non-load-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 unless noted otherwise by architect.

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3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.06 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.

3.07 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

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3.08 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 ACI 530.1/ASCE 6/TMS 602.
- 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 ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.09 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 meet specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "International Building Code."
 - 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.

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- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.10 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 cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.11 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.

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- 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. Fill material is specified in Section 31 20 00 "Earth Moving."
 - 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, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 22 00

SECTION 04 43 13.13 - ANCHORED STONE MASONRY VENEER

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. Stone masonry anchored to unit masonry backup.
- B. Products Installed but Not Furnished under This Section Include:
 - 1. Steel lintels in unit masonry.
 - 2. Steel shelf angles for supporting unit masonry.

1.3 ACTION SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.
- B. Samples for Verification:
 - 1. For each stone type indicated. Include at least two Samples in each set and show the full range of color and other visual characteristics in completed Work.
 - 2. For each color of mortar required. Label Samples to indicate types and amounts of pigments used.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, supply sources, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.
 - 1. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents contained in mockups unless Architect approves such deviations in writing.
- C. Material Test Reports:

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1. Stone Test Reports: For each stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous five years.
2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.
- B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 1. Build mockups for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.

Include a sealant-filled joint at least 16 inches long in mockup.

Include through-wall flashing installed for a 24-inch length in corner of mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit stone masonry above half of flashing).
 2. Protect accepted mockups from the elements with weather-resistant membrane.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the 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 end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.
- C. 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 stone masonry damaged by frost or 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 F and above and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.8 COORDINATION

- A. Advise installers of adjacent Work about specific requirements for placement of reinforcement, veneer anchors, flashing, and similar items to be built into stone masonry.
- B. Coordinate locations of dovetail slots installed in concrete that are to receive stone anchors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Stone: Obtain stone, from single quarry with resources to provide materials of consistent quality in appearance and physical properties.

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- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

2.2 LIMESTONE

2.3 Material Standard: Comply with ASTM C 568/C 568M.

- A. Description: Texas Hill Country limestone.
- B. Varieties and Sources: Provide local limestone.
- C. Match Architect's samples, if available, for color, finish, and other stone characteristics relating to aesthetic effects.

2.4 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.
 - 1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Aggregate: ASTM C 144 and as follows:
 - 1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
 - 2. White Aggregates: Natural white sand or ground white stone.
 - 3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
- D. Water: Potable.

2.5 VENEER ANCHORS

- A. Materials:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 1064/A 1064M; with ASTM A 153/A 153M, Class B-2.
 - 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
 - 3. Hot-Dip Galvanized-Steel Sheet: ASTM A 1008/A 1008M, cold-rolled, carbon-steel sheet, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M, Class B-2.

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- B. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.
- C. Adjustable Masonry-Veneer Anchors:
 - 1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
 - 2. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
- D. Polymer-Coated, Steel Tapping Screws for Concrete Masonry: Self-tapping screws with specially designed threads for tapping and wedging into masonry, with hex washer head and neoprene washer, 3/16-inch diameter by 1-1/2-inch length, and with organic polymer coating with more than 800-hour, salt-spray resistance to red rust per ASTM B 117.

2.6 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual] Section 07 62 00 "Sheet Metal Flashing and Trim" and as follows:
 - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
 - 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 - 3. Fabricate through-wall metal flashing embedded in masonry, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
 - 4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 - 5. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 6. Retain "Metal Drip Edges" or "Metal Sealant Stops" Subparagraph below, or both, for use with flexible flashing if required. See the Evaluations in Section 04 20 00 "Unit Masonry."
 - 7. Delete "Flexible Flashing" Paragraph below if only allowing metal flashing. If concealed metal flashing is required at certain locations, indicate those locations on Drawings or revise below.

Asphalt-Coated Copper Flashing: 5-oz./sq. ft. copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.

- B. Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

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1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- C. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.7 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. Cementitious Dampproofing for Limestone: Cementitious formulation recommended by ILL and nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.
- C. Asphalt Dampproofing: Cut-back asphalt complying with ASTM D 4479/D 4479M, Type I.
- D. Weep/Vent Products: Use one of the following unless otherwise indicated:
 1. Wicking Material: Absorbent rope, made from cotton or [UV-resistant synthetic fiber, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity behind stone masonry. Use only for weeps.
 2. Round Plastic Tubing: Medium-density polyethylene, 3/8-inch OD by thickness of stone masonry.
 3. Rectangular Plastic Tubing: Clear butyrate, 3/8 by 1-1/2 inches by thickness of stone masonry.
 4. Mesh Weep Holes/Vents: Free-draining mesh; made from polyethylene strands, full width of head joint and 2 inches high by thickness of stone masonry; in color selected from manufacturer's standard.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 1. Provide one of the following configurations:

Strips, full depth of cavity and 10 inches wide, with dovetail-shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.

Strips, not less than 3/4 inch thick and 10 inches wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.

2.8 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.

2.9 FABRICATION

- A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.
 - 1. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
- B. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Stone Masonry" Article.
 - 1. Shape stone specified to be laid in three-course, random range ashlar pattern with split beds.
- C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.
- D. Cut and drill sinkages and holes in stone for anchors and supports.
- E. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
 - 1. Clean sawed backs of stone to remove rust stains and iron particles.
- F. Thickness of Stone: Provide thickness indicated, but not less than the following:
 - 1. Thickness: 4 inches plus or minus 1/2 inch. Thickness does not include projection of pitched faces.
- G. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples.
 - 1. Finish: Split face.

2.10 MORTAR 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.
 - 2. Use portland cement-lime or mortar cement mortar unless otherwise indicated.

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3. 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.
 4. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the 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 Stone Masonry: Comply with ASTM C 270.
1. Mortar for Setting Stone: Type S.
 2. Mortar for Pointing Stone: Type N.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.
- B. Examine substrate to verify that dovetail slots, inserts, reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into stone masonry are correctly installed.
- C. Examine wall framing, sheathing, and weather-resistant sheathing paper to verify that CMU walls are suitable for spacing of veneer anchors and that installation will result in a weatherproof covering.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coat concrete and unit masonry backup with asphalt dampproofing.
- B. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING STONE MASONRY

- A. Perform necessary field cutting and trimming as stone is set.
 - 1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
 - 2. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
 - 3. Pitch face at field-split edges as needed to match stones that are not field split.
- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange stones in range ashlar pattern with course heights as approved, random lengths, and uniform joint widths, with offset between vertical joints as indicated.
- D. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
- E. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place.
- F. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
- G. Install steel lintels where indicated. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.
- H. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 3/8 inch at narrowest points or more than 1/2 inch at widest points.
- I. Provide sealant joints of widths and at locations indicated.
 - 1. Keep sealant joints free of mortar and other rigid materials.
 - 2. Sealant joints are specified in Section 07 92 00 "Joint Sealants."
- J. Install metal expansion strips in sealant joints at locations indicated. Build flanges of expansion strips into masonry by embedding in mortar between stone masonry and backup wythe. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
- K. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
 - 1. At multiwythe masonry walls, including cavity walls, extend flashing through stone masonry, turned up a minimum of 8 inches, and extend into or through inner wythe to comply with requirements in Section 04 20 00 "Unit Masonry."

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2. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end.
 3. At sills, extend flashing not less than 4 inches at ends.
 4. At ends of head and sill flashing, turn up not less than 2 inches to form end dams.
 5. Extend sheet metal flashing 1/2 inch beyond masonry face at exterior, and turn flashing down to form a drip.
 6. Install metal drip edges beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face and adhere flexible flashing to top of metal drip edge.
 7. Install metal flashing termination beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face and adhere flexible flashing to top of metal flashing termination.
 8. Cut flexible flashing flush with wall face after completing masonry wall construction.
- L. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.
1. Use wicking material, round plastic tubing, rectangular plastic tubing to form weep holes.
 2. Use wicking material to form weep holes above flashing in stone sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 3. Space weep holes 24 inches o.c.
 4. Trim wicking material used in weep holes flush with exterior wall face after mortar has set.
 5. Place pea gravel in cavities as soon as practical to a height of not less than 2 inches above top of flashing, to maintain drainage.
- M. Coat limestone with cementitious dampproofing as follows:
1. Stone at Grade: Beds, joints, and back surfaces to at least 12 inches above finish-grade elevations.
 2. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.
 3. Allow cementitious dampproofing formulations to cure before setting dampproofed stone. Do not damage or remove dampproofing in the course of handling and setting stone.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

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- C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.
- D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.
- E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.
- F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.5 INSTALLATION OF ANCHORED STONE MASONRY

- A. Anchor stone masonry to concrete with corrugated-metal veneer anchors unless otherwise indicated. Secure anchors by inserting dovetailed ends into dovetail slots in concrete.
- B. Anchor stone masonry to unit masonry with corrugated-metal or individual wire veneer anchors unless otherwise indicated. Embed anchors in unit masonry mortar joints or grouted cells at a distance of at least one-half of unit masonry thickness.
- C. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement by inserting pintles into eyes of masonry joint reinforcement projecting from unit masonry.
- D. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement with vertical rods inserted through anchors and through eyes of masonry joint reinforcement projecting from unit masonry.
- E. Anchor stone masonry to unit masonry with adjustable, screw-attached veneer anchors unless otherwise indicated. Fasten anchors to unit masonry with two screws.
- F. Anchor stone masonry to CMU walls with adjustable, screw-attached veneer anchors unless otherwise indicated. Fasten anchors through insulation to CMU with two screws.
- G. Anchor stone masonry to CMU walls with screw-attached veneer anchors unless otherwise indicated.
- H. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.
 - 1. Install continuous wire reinforcement in horizontal joints and attach to seismic veneer anchors as stone is set.
- I. Space anchors not more than 16 inches o.c. vertically and 24 inches o.c. horizontally. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.

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- J. Anchor stone trim with stone trim anchors where indicated. Install anchors by fastening to substrate and inserting tabs and dowels into kerfs and holes in stone units. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.
- K. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.
- L. Fill space between back of stone masonry and rigid insulation with mortar as stone is set.
- M. Provide 1-inch cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of mortar droppings and debris.
 - 1. Slope beds toward cavity to minimize mortar protrusions into cavity.
 - 2. Do not attempt to trowel or remove mortar fins protruding into cavity.
- N. Rake out joints for pointing with mortar to depth of not less than 1/2 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 POINTING

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.
- B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
 - 1. Joint Profile: Concave.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace stone masonry of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
 - 2. Defective joints.
 - 3. Stone masonry not matching approved samples and mockups.
 - 4. Stone masonry not complying with other requirements indicated.

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- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
 - 5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
 - 6. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 7. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.8 EXCESS MATERIALS AND WASTE

- A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.
- B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in greatest dimension.
 - 2. Mix masonry waste with at least 2 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, and other waste, and legally dispose of off Owner's property.

END OF SECTION 04 43 13.13

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
- B. Related Requirements:
 - 1. Section 05 31 00 "Steel Decking" for field installation of shear connectors through deck.
 - 2. Section 05 50 00 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame not defined as structural steel.

1.03 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- C. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.04 COORDINATION

- A. 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.

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1.05 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

1.06 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Nonshrink grout.
- B. Source quality-control reports.
- C. Field quality-control and special inspection reports.

1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.08 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.

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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.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Connections: 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.
 2. Use Allowable Stress Design; data are given at service-load level.
- B. Moment Connections: Type FR, fully restrained.
- C. Construction: Moment frame.

2.02 STRUCTURAL-STEEL MATERIALS

- A. Plate and Bar: ASTM A 36/A 36M.
- B. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- C. Welding Electrodes: Comply with AWS requirements.

2.03 BOLTS, CONNECTORS, AND ANCHORS

- A. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
1. Finish: Hot-dip zinc coating.
 2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.

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- B. 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, Type 1, hardened carbon steel.
 - 4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

- C. Threaded Rods: ASTM A 36/A 36M.
 - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 2. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - 3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

2.04 PRIMER

- A. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.05 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

- B. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

- C. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

- D. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

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2.06 SHOP CONNECTIONS

- A. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.07 SHOP PRIMING

- A. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag or flux deposits. Prepare surface according to the following specification. Specification is minimum required.
 - 1. SSPC SP3 "Power Tool Cleaning".
- B. Painting: Prepare steel and supply a one-coat nonasphaltic 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.

2.08 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Welded Connections: Visually inspect shop-welded connections 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 are not accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- C. Prepare test and inspection reports.

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PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates Leveling 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 303, "Code of Standard Practice for Steel Buildings and Bridges."

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- 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. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 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/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.05 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.

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- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

3.06 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 05 12 00

SECTION 05 31 00 - STEEL DECKING

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. Roof deck.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.04 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For steel deck.
- B. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

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- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.02 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 - 2. Deck Profile: As indicated.
 - 3. Profile Depth: As indicated.
 - 4. Design Uncoated-Steel Thickness: As indicated.
 - 5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
 - 6. Span Condition: As indicated.
 - 7. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.03 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

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- E. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- F. Galvanizing Repair Paint: ASTM A 780.
- G. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

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3.03 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

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3.05 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel framing and supports for countertops.
 - 2. Steel framing and supports for mechanical and electrical equipment.
 - 3. Shelf angles.
 - 4. Metal downspout boots.
 - 5. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Loose steel lintels.
 - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - 2. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 3. Section 05 12 00 "Structural Steel Framing."

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages,

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including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details. Provide Shop Drawings for the following:
 - 1. Steel framing and supports for countertops.
 - 2. Steel framing and supports for mechanical and electrical equipment.
 - 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 4. Shelf angles.
 - 5. Metal downspout boots.
 - 6. Loose steel lintels.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- C. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling,

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opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304 Type 316L.
- D. 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. Select fasteners for type, grade, and class required.
 1. Provide stainless-steel fasteners for fastening aluminum.
 2. Provide stainless-steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed

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when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

- G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM 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.
- H. Post-Installed Anchors: [Torque-controlled expansion anchors] [or] [chemical anchors].
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM 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.
- I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting." Section 09 91 23 Interior Painting."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

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- H. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
 - 5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- F. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- H. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- I. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

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2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize and prime shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with zinc-rich primer.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize and prime exterior miscellaneous steel trim.

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- D. Prime miscellaneous steel trim with zinc-rich primer.

2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.
- C. Prime plates with zinc-rich primer.

2.10 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize and prime loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 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.

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1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 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."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.14 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces 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:

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1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting." Section 09 91 23 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

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END OF SECTION 05 50 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 1. Wood blocking and nailers.
 2. Plywood backing panels.
 3. Oriented strand board.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. OSB: Oriented strand board.
- D. Timber: Lumber of 5 inches nominal size or greater in least dimension.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.

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4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

- A. 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. Shear panels.
 4. Power-driven fasteners.
 5. Post-installed anchors.
 6. Metal framing anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber 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.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2[for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground].

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1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- 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. Application: Treat all rough carpentry unless otherwise indicated.
 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 1. Treatment shall not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat [all rough carpentry unless otherwise indicated.] [items indicated on Drawings, and the following:]
 1. Concealed blocking.
 2. Plywood backing panels.

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2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
 2. Nailers.
 3. Cants.
 4. Furring.
 5. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
1. Hem-fir (north); NLGA.
 2. Mixed southern pine or southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB or WWPA.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 6. Western woods; WCLIB or WWPA.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.

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- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- E. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
- F. 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.
- G. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

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3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

- A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough 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 10 00

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Modified bituminous sheet waterproofing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
 - 1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
- C. Samples: For each exposed product and for each color and texture specified, including the following products:
 - 1. **8-by-8-inch (200-by-200-mm)** square of waterproofing and flashing sheet.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample Warranties: For special warranties.

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1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum **60-mil (1.5-mm)** nominal thickness, self-adhering sheet consisting of **56 mils (1.4 mm)** of rubberized asphalt laminated on one side to a **4-mil- (0.10-mm-)** thick, polyethylene-film reinforcement, and with release liner on adhesive side.
 - 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. [Carlisle Coatings & Waterproofing Inc.](#)
 - b. [MAPEI Corporation.](#)
 - c. [W. R. Meadows, Inc.](#)

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2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970/D 1970M.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836/C 836M.
 - e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154/E 154M.
 - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
 - g. Water Vapor Permeance: 0.05 perm (2.9 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
 - h. Hydrostatic-Head Resistance: 200 feet (60 m); ASTM D 5385.
3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm), predrilled at 9-inch (229-mm) centers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of **1/16 inch (1.6 mm)**.
- F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install **3/4-inch (19-mm)** fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.

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- b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071326

SECTION 071416 - COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Polyurethane waterproofing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings:
 - 1. Show locations and extent of waterproofing.
 - 2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
 - 3. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
- C. Samples: For each exposed product and for each color and texture specified, including the following products:
 - 1. Flashing sheet, **8 by 8 inches** (200 by 200 mm).

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

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- C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
 - 1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.
 - 2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.7 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing 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. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer. Subject to Compliance, Basis of Design: MEL-ROL LM Waterproofing System, W. R. MEADOWS®, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. www.wrmeadows.com.

2.2 SINGLE-COMPONENT POLYURETHANE WATERPROOFING

- A. Single-Component, Modified Polyurethane Waterproofing: ASTM C 836/C 836M and coal-tar free.
 - 1. Color: black.
 - 2. Solids: 70%.
 - 3. Total cure time: 16-24 hours.

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4. Shore "00" Hardness, ASTM C836: Passes
5. Adhesion to Concrete, ASTM C836: Exceeds
6. Low Temperature Flex and Crack Bridging, ASTM C836: Passes
7. Stability, ASTM C836: Exceeds
8. Elongation, ASTM D412: 1500%
9. Water Absorption, ASTM D1970: 0.7%
10. Water Vapor Transmission, ASTM E96 (Method B): 0.03 perms

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated.
- C. Sheet Flashing: 50-mil- (1.3-mm-) minimum, nonstaining, uncured sheet neoprene.
 1. Adhesive: Manufacturer's recommended contact adhesive.
- D. Membrane-Reinforcing Fabric: Manufacturer's recommended fiberglass mesh or polyester fabric, manufacturer's standard weight.
- E. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.
- F. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; as specified in Section 079200 "Joint Sealants"; and as recommended by manufacturer for substrate and joint conditions.
 1. Backer Rod: Closed-cell polyethylene foam.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.

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2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

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

3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

- A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to waterproofing manufacturer's written instructions and to recommendations in ASTM C 898/C 898M and ASTM C 1471/C 1471M.
- B. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

3.4 WATERPROOFING APPLICATION

- A. Apply waterproofing according to manufacturer's written instructions and to recommendations in ASTM C 898/C 898M and ASTM C 1471/C 1471M.
- B. Start installing waterproofing in presence of manufacturer's technical representative.
- C. Apply primer over prepared substrate unless otherwise instructed in writing by waterproofing manufacturer.
- D. Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
 1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a dry film thickness of **60 mils (1.5 mm)**.
 2. Apply waterproofing to prepared wall terminations and vertical surfaces.
 3. Verify manufacturer's recommended wet film thickness of waterproofing every **100 sq. ft. (9.3 sq. m)**.

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- E. Cure waterproofing, taking care to prevent contamination and damage during application and curing.

3.5 PROTECTION

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION 071416

SECTION 07 19 00 - WATER REPELLENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:

1. Natural stone.

1.3 ACTION SUBMITTALS

Product Data: For each type of product.

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's standard colors.
3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

Samples: For each type and color of water repellent and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

1.4 INFORMATIONAL SUBMITTALS

Product Certificates: For each type of water repellent.

Field quality-control reports.

Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

Applicator Qualifications: An employer of workers trained and approved by manufacturer.

MPI Standards: Comply with MPI standards indicated and provide water repellents listed in its "MPI Approved Products List."

1.6 WARRANTY

Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

Performance: Water repellents shall meet the following performance requirements as determined by testing on manufacturer's standard substrates representing those indicated for this Project.

Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:

1. Cast-in-Place Concrete: ASTM C 642.
2. Natural Stone: ASTM C 97/C 97M.

Water-Vapor Transmission: Comply with one or both of the following:

3. Maximum 10 percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E 96/E 96M.
4. Minimum 80 percent water-vapor transmission of treated compared to untreated specimens, according to ASTM D 1653.

Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E 514/E 514M.

Durability: Maximum 5 percent loss of water-repellent performance after 2500 hours of weathering according to ASTM G 154 compared to water-repellent-treated specimens before weathering.

2.2 MPI-APPROVED WATER REPELLENTS

Water Repellent, Clear (Not Paintable); MPI #117: Penetrating, silicone-oil type, clear water-repellent for interior or exterior masonry block or brick that will not be recoated with a coating other than the repellent.

1. Behr
2. Benjamin Moore
3. Columbia Paints
4. Sherwin Williams
5. VOC Content: 200 g/L or less.
6. MPI Green Performance Standard: GPS-1.

PART 3 - EXECUTION

3.1 EXAMINATION

Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
3. Verify that required repairs are complete, cured, and dry before applying water repellent.

Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.

Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.

Protect adjoining work, including mortar and 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 vegetation.

Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

Coordination with Sealant Joints: 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 required.

3.3 APPLICATION

Apply coating of water repellent on surfaces to be treated using 15 psi-pressure spray with a fan-type spray nozzle or brush to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

1. Precast Concrete: At Contractor's option, first application of water repellent may be completed before installing units. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces. Remove masking after repellent has cured.

Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:

1. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect..

Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.

2. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
3. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 19 00

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Extruded polystyrene foam-plastic board - walls.
 - 2. Polyisocyanurate foam-plastic board - roof.
- B. Related Requirements:
 - 1. Section 04 20 00 "Unit Masonry" for insulation installed outside masonry cavity walls.
 - 2. Section 07 41 13.16 "Standing Seam Metal Roof Panels" for roof insulation.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.

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- B. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 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 (The).
 - c. Owens Corning.
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 POLYISOCYANURATE RIGID COMPOSITE BOARD

- A. Polyisocyanurate Board, Oriented Strand Board Faced: ASTM C 1289, Type I, Class 1 or 2.
- B. Standard APA/TECO rated OSB.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Carlisle Coatings & Waterproofing Inc.
 - c. Dow Chemical Company (The).
 - d. Firestone Building Products.
 - e. GAF Cornell Corporation.
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- 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. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

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- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
 - 1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 "Unit Masonry."

3.4 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS

GENERAL

1.1 RELATED DOCUMENTS

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 standing-seam metal roof panels.

1.3 ACTION SUBMITTALS

Product Data: For each type of product.

1. Include manufacturer's literature, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

Shop Drawings:

2. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
3. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

4. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

Qualification Data: For Installer.

Product Test Reports: For each product, for tests performed by a qualified testing agency.

Field quality-control reports.

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1.5 CLOSEOUT SUBMITTALS

Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

Metal roof assemblies shall comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

- B. Contractor must provide proof as a licensed installer with all current and applicable licensures per the 2010 UGC and Special Conditions.
- C. Contractor must show evidence of 3 years prior experience in roof installation to be eligible for award of this contract.
- D. Contractor to provide his own equipment for rolled roofing or other fabrications.

DELIVERY, STORAGE, AND HANDLING

Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package off site fabricated metal roof panels for protection during transportation and handling.

Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

Contractor shall be responsible for the proper care and protection of all materials, supplies, and equipment stored at the job site.

Store all material according to manufacturer recommendations.

1.7 FIELD CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

Contractor shall furnish a certificate of warranty from the manufacturer for free from defects in the products.

Provide a twenty-five (25) year manufacturer's finish warranty.

PRODUCTS

1.10 STRUCTURAL PERFORMANCE

Provide metal roof panel assemblies capable of withstanding the effect of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to **ASTM E 1592 structural loading test with maximum deflection 1/240** and **ASTM E 331 water penetration under static pressure test** for IBC 90 mph wind rating (3 second gust).

1.11 STANDING-SEAM METAL ROOF PANELS

Install 24 gauge galvalume standing seam roof system with double folded, min. 1½" high standing seams.

Install synthetic roofing underlayment over ¾" oriented strand board over polyisocyanurate foam rigid insulation board meeting ASTM D226, ASTM D4869, ASTM E108/UL 790 (Class A Fire Resistance).

Provide and install sealant tape and sealants as recommended by the metal roofing manufacturer for a water tight installation.

Roof panels may be fabricated on site.

1.12 MISCELLANEOUS MATERIALS

Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.

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2. 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 panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

Flashing and Trim: Provide flashing and trim formed from same material as metal panels 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 panels.

Panel Fasteners: Self-tapping screws designed to withstand design loads.

Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

4. 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.
5. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
6. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

1.13 FABRICATION

On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

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4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

1.14 FINISHES

Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.15 EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

Proceed with installation only after unsatisfactory conditions have been corrected.

1.16 PREPARATION

Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

1.17 METAL PANEL INSTALLATION

General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

Fasteners:

9. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
10. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

11. Install clips to supports with self-tapping fasteners.

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12. Install pressure plates at locations indicated in manufacturer's written installation instructions.
13. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
14. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
15. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

16. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

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.

17. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
18. 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 weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

1.18 THERMAL INSULATION INSTALLATION

Board Insulation: Extend insulation thickness indicated to cover entire roof. Comply with installation requirements in 07 21 00 Thermal Insulation.

1. Erect insulation and hold in place with fasteners spaced per manufacturer's recommendations.

1.19 ERECTION TOLERANCES

Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

1.20 CLEANING AND PROTECTION

Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13.16

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Mildew-resistant joint sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

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1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 FIELD 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.

1.7 WARRANTY

- A. Special Installer's Warranty: 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: Five years from date of Substantial Completion.
- B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and

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application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

- 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. Dow Corning Corporation.
 - b. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - c. Pecora Corporation.

- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - b. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - c. Pecora Corporation.

2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - b. Pecora Corporation.
 - c. Sika Corporation; Joint Sealants.

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2.4 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - b. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - c. Pecora Corporation.

2.5 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Alcot Plastics Ltd.
 - b. BASF Corporation; Construction Systems.
- B. Cylindrical Sealant Backings: ASTM C 1330, [Type C (closed-cell material with a surface skin)] [Type O (open-cell material)] [Type B (bicellular material with a surface skin)] [or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated], and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances

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capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. 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. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
- 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

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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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of 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.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints in dimension stone cladding.
 - c. Joints between metal panels.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors windows and louvers.
 - f. Control and expansion joints in ceilings and other overhead surfaces.
 - g. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of unit masonry walls and partitions.
 - d. Joints on underside of plant-precast structural concrete beams and planks.
 - e. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, S, NS, 25, NT.

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3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors windows.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Acrylic latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Concealed mastics.
1. Joint Locations:
 - a. Sill plates.
 - b. Other joints as indicated on Drawings.
 2. Joint Sealant: Butyl-rubber based.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.

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5. Details of each different wall opening condition.
 6. Details of anchorages, joints, field splices, and connections.
 7. Details of accessories.
 8. Details of moldings, removable stops, and glazing.
 9. Details of conduit and preparations for power, signal, and control systems.
- C. Samples for Verification:
1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
- D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Ceco Door; ASSA ABLOY.
 2. Curries Company; ASSA ABLOY.

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3. Deansteel Manufacturing Company, Inc.
4. Door Components, Inc.

- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - f. Core: Kraft-paper honeycomb Polystyrene Vertical steel stiffener.
3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.4 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.

2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z 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.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

2.6 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.

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2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 3. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, 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 one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Compression Type: Not less than two anchors in each frame.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 6. Terminated Stops: Terminate stops 6 inches above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

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- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.8 ACCESSORIES

- A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
 - 2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

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- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 - 2. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 3. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 - 4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

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5. 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.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
 - c. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

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SECTION 08710 – FINISH HARDWARE

PART 1 – GENERAL:

1.01 SUMMARY:

- A. Section includes the supply and installation of the Finish Hardware.
- B. Related Sections
 - 1. Division 1
 - 2. Openings – Division 8 / Division 8

1.02 REFERENCES:

- A. Documents and Institutes that shall be used in estimating, detailing and installing the items specified.
 - 1. International Building Code – Current/Adopted Edition
 - 2. ICC/ANSI A117.1 – Accessible and Usable Building and Facilities -
 - 3. Current/Adopted Edition
 - 4. NFPA80 –Standards For Fire Doors and Fire Windows – Current/Adopted Edition
 - 5. NFPA101 – Life Safety Code – Current/Adopted Edition
 - 6. NFPA105 – Installation of Smoke-Control Door Assemblies – Current/Adopted Edition.
 - 7. ANSI - American National Standards Institute
 - 8. BHMA – Builders Hardware Manufacturers Association
 - 9. UL – Underwriters Laboratory
 - 10. Texas Accessibility Standards – Current Adopted Edition
 - 11. Local Building Codes

1.03 SUBMITTALS

- A. Comply with pertinent provisions of Section 01300.
- B. Finish Hardware Schedule to be in vertical format to include:
 - 1. Heading #/Hardware Set
 - 2. Door #, Location, Hand, Degree of Opening, Door Size and Type, Frame Size and Type, Fire Rating
 - 3. Quantity, type, style, function, product, product number, size, fasteners, finish and manufacturer of each hardware item.
 - 4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - 5. Keying schedule
 - 6. Title Sheet, Index, Abbreviations, Manufacturers List, Template List and Templates.
 - 7. Mounting locations for hardware.
 - 8. Explanation of abbreviations, symbols, and codes contained in schedule.

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9. Date of the Finish Hardware Specification and Drawing / Door Schedule used in completing the Finish Hardware Schedule.
-
- C. Product Data: Provide product data in the form of a binder, manufacturer's technical product fact sheets for each item of hardware. Include whatever information may be necessary to show compliance with requirements, including instructions for installation and for maintenance of operating parts and finish.
 - D. Samples: Provide samples as requested by owner or architect with Heading # and Door# marked on boxes. All samples will be returned to the contractor and used on doors for which they were marked.
 - E. Templates: Provide templates of finish hardware items to each fabricator of doors, frames and other work to be factory or shop prepared for the installation of hardware.
 - F. Keying Schedule: A keying schedule shall be submitted using keyset symbols referenced in DHI manual "Keying Systems and Nomenclature." The keying schedule shall be indexed by door number, keyset, hardware heading number, cross keying instructions and special key stamping instructions.
 - G. Operations and maintenance data: At the completion of the job, provide to the owner two copies of an Owner's operation and maintenance manual. The manual shall consist of a labeled hardcover three ring binder with the following technical information:
 1. Title page containing: Project name, address and phone numbers.
Supplier's name, address and phone numbers.
 2. Table of Contents.
 3. Copy of final Finish Hardware Schedule and Keying Schedule
 4. Maintenance instruction for each item of hardware.
 5. Catalog pages for each product.
 6. Installation Instructions and Parts List for all Locks, Exit Devices and Door Closers.

1.04 QUALITY ASSURANCES

- A. Substitutions: Request for substitutions shall not be accepted within this project. Architect, owner and Hardware Consultant have selected one (1) specified and two (2) equals listed hereinafter in the Hardware Schedule. By this selection process they have established three (3) equal products for competitive pricing, while insuring no unnecessary delays by a substitution process. If any specified product is listed as a "No Substitution" product, this product will be supplied as specified, with no alteration or request of substitution. The reason for this is to comply with the uniformity established at this project. Parts and supplies are inventoried for these particular products for ease and standardization of replacement.

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- B. Supplier Qualifications: Supplier shall be recognized architectural finish hardware supplier, with warehousing facilities, who have been furnishing hardware in the project vicinity for a period of not less than 2 year and who is or employs a DHI Certified AHC or person with a minimum of 10 years of experience as a hardware supplier. This person shall be available at reasonable times during the course of the work for consultation about products hardware requirements, to the owner, architect and contractor.
- C. Installer Qualifications (Mechanical Hardware): All finish hardware shall be installed by the finish hardware installer with a minimum of at least two (2) years documented experience. Installer shall attend a pre-installation meeting between the contractor, finish hardware supplier, hardware manufacturer's representative for locks, closers and exit devices, all door / frame suppliers. The finish hardware installer shall be responsible for the proper installation and function of all doors and hardware.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Marking and packaging: Mark each item or package separately, with identification related to hardware set number, door number and keyset symbol.
- B. Delivery:
 - 1. Deliver individually packaged and properly marked finish hardware at the proper time and location to avoid any delays in construction or installation.
 - 2. At time of delivery, inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- C. Storage: Store hardware in enclosed, dry and locked area.

1.06 WARRANTY

- A. All finish hardware products shall be covered by a 1 year factory warranty from the date of substantial completion of the project. Exit Devices shall carry a 3-year warranty, Mechanical Door Closers shall carry a 10-year warranty.
- B. Supply warranty verification to the owner for all products that provide factory warranty.

1.07 MAINTENANCE:

- A. Maintenance Service
 - 1. None
- B. Extra Materials:

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1. All extra screws, fasteners, and all special installation tools furnished with the hardware shall be turned over to the owner at the completion of the job.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Screws and Fasteners:

1. All closers and exit devices provided for exterior doors, hollow metal doors, and all other required shall be provided with thru-bolts.
2. All finish hardware shall be installed to manufacturer's recommendations, using screws, attachments and installation tools provided with the hardware. No other screws or attachments are acceptable.
3. All other products to meet door and frame conditions.

B. Continuous Hinges

1. Continuous hinges to be manufactured of 6063-T6 aluminum alloy with anodized finish.
2. Continuous hinge to be cut in the field for power transfer.
3. Continuous hinge shall be certified to ANSI 156.25, Grade 2
4. Continuous hinge should be tested an approved UL10C.
5. Supply from the following list of manufacturers:
Ives IVE www.ives.ingersollrand.com
Select SEL www.select-hinges.com
Zero ZER www.zerointernational.com

C. Mortise Locks

1. Mortise locksets shall meet Grade 1 operational requirement ANSI/BHMA A156.13, Series 1000, Operational Grade 1 and Security Grade 1 with all standard trims and conventional mortise cylinders.
2. All mortise locks shall be UL 10B- neutral pressure and UL10C/UBC 7 – 2 – positive pressure testing requirement. All locks shall be UL listed for 3 hour fire door.
3. Lock case shall be non-handed, reversible without opening the lock case, and shall be manufactured of zinc dichromate plated steel. Lock case shall be interchangeable for knob or lever applications without modifying the chassis, and shall be constructed with a screw configuration that limits access to operating parts.
4. Latchbolt shall be 2 – piece anti-friction type manufactured from stainless steel, with a standard 2 3/4" backset, a full 3/4" throw and be field reversible. Deadbolt shall have 1" throw and shall be constructed of stainless steel, incorporating two 3/16" diameter security roller pins.
5. All trim shall be cast, forged, or wrought and through-bolted with thread patch coated screws. Lever trim to have individual heavy duty springs for lever return, and independent rotation in both direction.
6. Spindles to be independent, designed to 'break-away' at a maximum of 480 in./lbs. to prevent damage to the lock chassis.

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7. Provide standard non-handed curved lip strikes. Cylinders to be secured by a dual retainer.
 8. Supply from the following list of manufacturers:
Best BES www.bestaccess.com 45K
- D. Pull Plates/Pulls
1. Pull Plates to meet ANSI 156.6 for .050" thickness. Plate size to 4" x 16" with 1" round on pull plate.
 2. Provide concealed fasteners for all applications.
 3. Supply from the following list of manufacturers
Ives IVE www.ives.ingersollrand.com
Trimco TRI www.trimcobbw.com
Rockwood ROC www.rockwoodmfg.com
- E. Push Plates
1. Push Plates to meet ANSI 156.6 for .050" thickness. Plate size to be 4" x 16".
 2. Supply from the following list of manufacturers
Ives IVE www.ives.ingersollrand.com
Trimco TRI www.trimcobbw.com
Rockwood ROC www.rockwoodmfg.com
- F. Door Closers
1. All door closers on this project should be manufactured by the same manufacturer.
 2. Door closers shall meet the minimum requirements of the 1990 ADA act, in lieu of ANSI Standard A156.4 and ANSI, Grade 1 on interior fire rated openings.
 3. Door closers shall be furnished with standard cover. Provide full cover as shown in hardware sets.
 4. Size in accordance with the manufacturers recommendations for door size and condition.
 5. Door closers shall be furnished with backcheck, delayed action, hold-open and advanced backcheck as listed in the Hardware Sets.
 6. Door closers shall be mounted out of the line of sight wherever possible (i.e., room side of corridor doors, etc.) with parallel arm mounting on out swinging doors.
 7. Provide and mount closer top jamb or on brackets and/or drop plates, where special conditions call for it.
 8. All closer installation shall include thru bolts on exterior, hollow metal doors or where required for application.
 9. Provide special template where required by application (i.e., coordinator installation).
 10. Supply from the following list of manufacturers
LCN LCN www.lcnclosers.com
Dromatic/Falcon DOR/FAL www.falconlock.com
Norton NOR www.nortondoорcontrols.com

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- G. Door Protection Plates
1. Protective plates shall meet ANSI A156.6 requirements for .050 thickness.
 2. Protection plates should be fabricated from stainless steel.
 3. Kickplates shall be 10" by 2" less than door width on single door and 1" less than door width on pair of doors or as indicated in hardware sets. Beveled 4 edges.
 4. Provide kickplate on all wood doors with closers, unless not required for aesthetic reasons.
 5. Supply from the following list of manufacturers:

Ives	IVE	www.ives.ingersollrand.com
Rockwood	ROC	www.rockwoodmfg.com
Trimco	TRI	www.trimcobbw.com
- H. Door Stops and Holders:
1. Wall and Floor Stops: Supply wall stops where needed to protect doors or door hardware. When wall conditions do not permit use of wall stop provide floor stops with risers as needed to adjust for floor conditions.
 2. Where Wall Stops are used, install so lock does not lock unintentionally.
 3. Overhead Stops: Where wall or floors stops are not applicable provide concealed or surface overhead stops.
 4. Exterior Stops: Provide security floor stop.
 5. Supply from the following list of manufacturers:

Ives	IVE	www.ives.ingersollrand.com
Glynn Johnson	GLY	www.glynn-johnson.com
Trimco	TRI	www.trimcobbw.com
- I. Silencers
1. Provide silencers on all doors without seal. 3 for single doors and 2 for pairs.
 2. Provide silencers as required for frame conditions. SR64 for hollow metal frames. SR65 for wood frames.
 3. Supply from the following list of manufacturer's

Ives	IVE	www.ives.ingersollrand.com
Rockwood	ROC	www.rockwoodmfg.com
Trimco	TRI	www.trimcobbw.com
- J. Thresholds/Weatherstripping
1. All thresholds shall conform to state and local handicap codes.
 2. Smoke seal shall be teardrop design bulb seal.
 3. Exterior seal/thresholds shall be silicone or brush as shown in hardware sets.
 4. Sound seal shall be silicone.
 5. Drip strips shall protrude 2 1/2" and be 4" wider than opening..
 6. Provide door sweeps.
 7. Provide UL meeting stile gasketing for fire rated doors.
 8. Supply from the following list of manufacturer's

Zero	ZER	www.zerointernational.com
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National Guard	NGP	www.ngpinc.com
Hager Hinge Company	HAG	www.hagerhinge.com
Pemko	PEM	www.pemko.com

2.03 KEYING:

- A. General: Finish Hardware Supplier shall meet in person with owner to finalize keying requirements prior to the locks and exit devices being ordered and match existing or start a new Master Key System for the project. During keying meeting all hardware functions should be reviewed with the owner to finalize lock functions.
- B. Cylinders: All cylinder/cores on this project should be manufactured and providing in the same keyway.
- C. Cylinders: Provide the correct and quantity of cylinders for all applications.
- D. Keys: Provide nickel silver keys only. Furnish 2 change keys for each lock: 5 control keys: 5 master keys for each master system and 5 grandmaster keys for each grandmaster key system. Deliver all keys to owners' representative.
- E. Cores and keys shall be provided with identification stamping.
- F. Provide construction keying / construction cores for this project with constructions keys.

2.04 KEY CONTROL:

- A. Key Management: Key control shall be provided, by supplying a complete key storage and management system. Each key shall be fully cut, indexed, tagged and installed on cabinet hooks by the lock supplier and shipped with the locks. Key cabinet provided shall be wall-mounted type with capacity plus 50%.

PART 3 – EXECUTION:

3.01 EXAMINATION:

- A. Examine doors, frames and related items for conditions that would prevent the proper application of any finish hardware items. Do not proceed with installation until all defects are corrected.

3.02 INSTALLATION:

- A. Follow Door and Hardware Institute Publication for:
Recommended Location for Architectural Hardware for Standard Steel Doors and Frames
Recommended Location for Builder's Hardware for Custom Steel Doors and Frames
Recommended Locations for Architectural Hardware for Wood Flush Door

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- B. Follow ANSI A117.1-1998 Accessible and Usable Building and Facilities
- C. Review mounting locations with Architect.
- D. Pre Installation meeting required with attendees to include Architect, Contractor, Mechanical Hardware and Electrified Hardware Installer, Finish Hardware Supplier and Manufacturer's Representative for Exit Device, Locks and Closers before installation begins.

3.03 FIELD QUALITY CONTROL:

- A. After installation has been completed, obtain the services of an Architectural Hardware Consultant to check for proper installation of finish hardware, according to the finish hardware schedule and keying schedule. In addition, check all hardware for adjustments and proper operation.

3.04 ADJUST AND CLEAN:

- A. Adjust, clean and inspect all hardware, to ensure proper operation and function of every opening. Replace items, which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.05 PROTECTION:

- A. The general contractor shall use all means at his disposal to protect all finish hardware items from abuse, corrosion and other damage until the owner accepts the project as complete.

3.07 TRAINING

- A. After installation has been completed, provide training to the Owner on the operation of finish hardware and programming of any access control items.

3.06 HARDWARE SCHEDULE

- A. These hardware set shown below are for use as a guideline. Provide hardware as required to meet the requirements of the openings, security, and code requirements.

HARDWARE SET LAYOUT

- 00 – Existing, No Hardware Required or Cylinders
- 01 – Panic or Fire Exit Hardware
- 02 – Lockset – Storeroom
- 03 – Lockset - Office
- 04 – Lockset – Classroom
- 05 – Latchset – Privacy
- 06 – Latchset - Passage

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07 – Push and/or Pull

HARDWARE GROUP NO. 02.01

FOR USE ON MARK/DOOR #(S):

103 104

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONTINUOUS HINGE	112HD	628	IVE
1	EA	STOREROOM LOCKSET	45H7D 14H	626	BES
1	EA	SURFACE CLOSER	SC71 SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	485A (JAMBS)		ZER
1	EA	GASKETING	429A (HEAD)		ZER
1	EA	DOOR SWEEP	39A		ZER
1	EA	THRESHOLD	655A		ZER
1	EA	RAIN DRIP	142A		ZER

HARDWARE GROUP NO. 07.01

FOR USE ON MARK/DOOR #(S):

101 102

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONTINUOUS HINGE	112HD	628	IVE
1	EA	CLASSROOM DEADLOCK	45H7RD	626	BES
1	EA	PULL PLATE	8303 10" 4 X 16	630	IVE
1	EA	PUSH PLATE	8200 4 X 16	630	IVE
1	EA	SURFACE CLOSER	SC71 SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	485A (JAMBS)		ZER
1	EA	GASKETING	429A (HEAD)		ZER
1	EA	DOOR SWEEP	39A		ZER
1	EA	THRESHOLD	655A		ZER
1	EA	RAIN DRIP	142A		ZER

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END OF SECTION

SECTION 08 91 19 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed, extruded-aluminum and formed-metal louvers.
- B. Related Requirements:
 - 1. Section 08 11 13 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- D. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

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- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- C. Samples: For each type of metal finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Windborne-debris-impact-resistance test reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Subject to Compliance, Basis of Design: Architectural Louvers, 1-888-Louver1 (568-8371)
 - 1. Type: EJ2S Wall Louver
 - 2. Size: 2 inch flat blade louver
 - 3. Material: Heavy gauge 0.063" thickness aluminum extrusion
 - 4. Finish: Anodized aluminum
 - 5. Screen: Internal insect screen
 - 6. Color: Selected from manufacturer's standard aluminum color chart.

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7. Free Area: 48.7% free area for a 48" wide x 48" high louver.
8. 725 fpm first point of water penetration
9. 30 psf wind load rating

2.2 PERFORMANCE REQUIREMENTS

- A. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

2.3 LOUVER SCREENS

- A. General: Provide screen at each louver.
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Insect screening.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Same finish as louver frames to which louver screens are attached.
 3. Type: Rewirable frames with a driven spline or insert.
- D. Louver Screening for Aluminum Louvers:
 1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.
 2. Panel Finish: Same finish applied to louvers.

2.4 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 1. Use Phillips flat-head tamper-resistant screws for exposed fasteners unless otherwise indicated.
 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

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2.5 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern where indicated.
 - 2. Horizontal Mullions: Provide horizontal mullions at joints where indicated.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
 - 2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with semirecessed mullions at corners.
- G. Provide subsills made of same material as louvers for recessed louvers.
- H. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, [AA-M12C22A42/A44, Class I, 0.018 mm] [AA-M12C22A32/A34, Class II, 0.010 mm] or thicker.
 - 1. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

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- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 19

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes resinous flooring systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. Samples for Initial Selection: For each type of exposed finish required.
- C. Samples for Verification: For each resinous flooring system required, **6 inches (150 mm)** square, applied to a rigid backing by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- B. Material Certificates: For each resinous flooring component, from manufacturer.
- C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

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- B. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- C. Mockups: Build in-place mockup 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 96-inch- (2400-mm-) square floor area selected by Architect.
 - a. Include 96-inch (2400-mm) length of integral cove base with inside corner.
 - 2. Simulate finished lighting conditions for Architect's review of mockups.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver 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.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Flammability: Self-extinguishing according to ASTM D 635.

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2.2 MANUFACTURERS

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

2.3 RESINOUS FLOORING

- A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.
1. Basis of Design: Dur-A-Flex, Inc, (860) 528-9838; Dur-A-Quartz, Epoxy-Based seamless flooring system.
 - A. System Materials:
 1. Primer: Dur-A-Flex, Inc, Dur-A-Glaze #4 WB resin and hardener.
 2. Broadcast Coats: Dur-A-Flex, Inc, Dur-A-Glaze #4 resin and hardener.
 3. The quartz aggregate shall be Dur-A-Flex, Inc. Q-28 or Q-11 colored quartz aggregate.
 4. Grout Coat: Dur-A-Flex, Inc. Dur-A-Glaze #4 resin and Water Clear hardener.
 5. Topcoat: Dur-A-Flex, Inc. Armor Top resin, hardener and grit.
 - B. Patch Materials
 1. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Dur-A-Glaze # 4 Cove-Rez.
 2. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Dur-A-Crete.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. [Arizona Polymer Flooring, Inc.](#)
- b. [Delta Polymers, Inc.](#)
- c. [Duraflex, Inc.](#)
- d. [Garland Company, Inc. \(The\).](#)

B. System Characteristics:

1. Color and Pattern: As selected by Architect from manufacturer's full range.
2. Wearing Surface: Textured for slip resistance.
3. Overall System Thickness: **3/16 inch (4.8 mm)**.

C. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.

1. Formulation Description: 100 percent solids.

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- D. Waterproofing Membrane: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.
 - 1. Formulation Description: 100 percent solids.
- E. Reinforcing Membrane: Flexible resin formulation that is recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from reflecting through resinous flooring.
 - 1. Formulation Description: 100 percent solids.
 - a. Provide fiberglass scrim embedded in reinforcing membrane.
- F. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- G. Body Coats:
 - 1. Resin: Epoxy.
 - 2. Formulation Description: 100 percent solids.
 - 3. Type: Clear].
 - 4. Application Method: Troweled or screeded.
 - 5. Number of Coats: Three.
 - 6. Thickness of Coats: 1/16 inch (1.6 mm).
 - 7. Aggregates: Manufacturer's standard.
- H. Grout Coat:
 - 1. Resin: Epoxy.
 - 2. Formulation Description: 100 percent solids.
 - 3. Type: Clear].
 - 4. Thickness of Coat: 8 mils (0.2 mm).
- I. Topcoats: Sealing or finish coats.
 - 1. Resin: Epoxy.
 - 2. Formulation Description: 100 percent solids.
 - 3. Type: Clear.
 - 4. Number of Coats: Two.
 - 5. Thickness of Coats: 1/16 inch (1.6 mm).
 - 6. Finish: Matte.
- J. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
 - 1. Compressive Strength: Insert value > minimum according to ASTM C 579.
 - 2. Tensile Strength: > minimum according to ASTM C 307.
 - 3. Flexural Modulus of Elasticity: minimum according to ASTM C 580.
 - 4. Water Absorption: percent maximum according to ASTM C 413.
 - 5. Shrinkage: percent maximum according to ASTM C 531.
 - 6. Indentation: < percent maximum according to MIL-D-3134J.
 - 7. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch (1.6-mm) permanent indentation according to MIL-D-3134J.

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8. Resistance to Elevated Temperature: No slip or flow of more than **1/16 inch (1.6 mm)** according to MIL-D-3134J.
 9. Abrasion Resistance: maximum weight loss according to ASTM D 4060.
 10. Hardness: Insert value, Shore D according to ASTM D 2240.
 11. Critical Radiant Flux: 0.45 W/sq. cm or greater according to NFPA 253.
- K. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D 1308 for 50 percent immersion] in the following reagents for no fewer than seven days:

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- B. 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 resinous flooring.
 1. Roughen concrete substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.
 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
 3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of **3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)** of slab area in 24 hours.
 - b. Plastic Sheet Test: ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
 - c. Relative Humidity Test: Use in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum **[75] <Insert number>** percent relative humidity level measurement.
 4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

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- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
 - 1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.2 APPLICATION

- A. Apply components of resinous flooring 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 resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Waterproofing Membrane: Apply waterproofing membrane over entire substrate surface, in manufacturer's recommended thickness.
 - 1. Apply waterproofing membrane to integral cove base substrates.
- D. Reinforcing Membrane: Apply reinforcing membrane to entire substrate surface.
- E. 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. Integral Cove Base: 8 inches high.
- F. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness indicated for flooring system.
 - 1. Aggregates: Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.
- G. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When body

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coats are cured, remove trowel marks and roughness using method recommended by manufacturer.

- H. Grout Coat: Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat.
- I. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.

3.3 FIELD QUALITY CONTROL

- A. Core Sampling: At the direction of Owner and at locations designated by Owner, take one core sample per 1000 sq. ft. (92.9 sq. m) of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

3.4 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel and iron.
 - 2. Galvanized metal.
 - 3. CMU.
- B. Related Requirements:
 - 1. Section 05 12 00 "Structural Steel Framing" for shop priming of metal substrates.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

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1. Submit Samples on rigid backing, 8 inches square.
 2. Apply coats on Samples in steps to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

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1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Glidden Professional.
 - 4. Kelly-Moore Paint Company Inc.
 - 5. The Sherwin Williams Company
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 50 g/L.
 - 3. Dry-Fog Coatings: 150 g/L.
 - 4. Primers, Sealers, and Undercoaters: 100 g/L.
 - 5. Rust-Preventive Coatings: 100 g/L.

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6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
 7. Pretreatment Wash Primers: 420 g/L.
- D. Colors: Match Architect's samples.

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 the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 1. SSPC-SP 2.

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2. SSPC-SP 3.

- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- H. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Latex System MPI EXT 3.1K:
Prime Coat: Primer, alkali resistant, water based, MPI #3.
Intermediate Coat: Latex, exterior, matching topcoat.
Topcoat: Latex, exterior, flat
- B. CMU Substrates:
 - 1. Epoxy over Alkali-Resistant Primer System MPI EXT 4.2L:
Prime Coat: Primer, alkali resistant, water based, MPI #3.
Intermediate Coat: epoxy, exterior, matching topcoat.
Topcoat: Epoxy, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.
- C. Steel and Iron Substrates:
 - 1. Water-Based Light Industrial Coating System MPI EXT 5.1M:
Prime Coat: Primer, rust inhibitive, water based[MPI #107].

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Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.

Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.

D. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System MPI EXT 5.3J:

Prime Coat: Primer, galvanized, water based, MPI #134.

1) Sherwin Williams, Pro-Industrial, Pro-Cryl Universal Primer

Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.

Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.

Sherwin Williams, Pro-Industrial, DTM Acrylic Eg-shell

E. Aluminum Substrates:

1. Water-Based Light Industrial Coating System[MPI EXT 5.4G:

Prime Coat: Primer, quick dry, for aluminum, MPI #95.

1) Sherwin Williams, Protective and Marine Coatings, kem Kromik Universal Primer.

Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.

Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.

2) Sherwin Williams, Pro- Industrial, DTM Acrylic Eg Shell.

END OF SECTION 09 91 13

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMUs).
 - 3. Steel and iron.
 - 4. Galvanized metal.
- B. Related Requirements:
 - 1. Section 05 12 00 "Structural Steel Framing" Section 05 12 13 "Architecturally Exposed Structural Steel Framing" for shop priming structural steel.
 - 2. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

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1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
 - 3. Submit Samples on rigid backing, 8 inches square.
 - 4. Apply coats on Samples in steps to show each coat required for system.
 - 5. Label each coat of each Sample.
 - 6. Label each Sample for location and application area.
- B. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Benjamin Moore & Co.
 2. Dulux (formerly ICI Paints); a brand of AkzoNobel.
 3. Kelly-Moore Paint Company Inc.
 4. The Sherwin Williams Company
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 50 g/L.
 3. Primers, Sealers, and Undercoaters: 100 g/L.
 4. Rust-Preventive Coatings: 100 g/L.
 5. Pretreatment Wash Primers: 420 g/L.
- D. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Colors: As indicated in a color schedule.

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 the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMUs): 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

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- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 3.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:

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- a. Equipment, including panelboards[and switch gear].
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Other items as directed by Architect.
 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

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3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Latex System, Alkyd Primer MPI INT 5.1Q:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.
2. Water-Based Dry-Fall System MPI INT 5.1C:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Topcoat: Dry fall, latex (MPI Gloss Level 5), MPI #226.

B. Galvanized-Metal Substrates:

1. Latex System MPI INT 5.3A:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, low sheen.

C. Concrete Substrates, Nontraffic Surfaces:

1. Water-Based Concrete Floor Sealer System MPI INT 3.2G:
 - a. First Coat: Sealer, water based, for concrete floors, matching topcoat.
 - b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

D. CMU Substrates:

1. Latex System MPI INT 4.2A:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Epoxy, interior, matching topcoat.
 - c. Topcoat: Epoxy, interior, low sheen (MPI Gloss Level 5), MPI #54.
2. High-Performance Architectural Epoxy System MPI INT 4.2D (Showers):
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.

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- b. Prime Coat: Primer, alkali resistant, water based, MPI #3.
- c. Intermediate Coat: Water based epoxy, interior, high performance architectural, matching topcoat.
- d. Topcoat: Water based epoxy, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

END OF SECTION 09 91 23

SECTION 10 14 23.13 - ROOM-IDENTIFICATION SIGNAGE

GENERAL

1.1 SUMMARY

- A. Section includes room-identification signs that are directly attached to the building.
- B. Section includes aluminum letters at restroom entrances.

1.2 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.3 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.**

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, timesteps, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
 - 4. Include representative Samples of available timesteps and graphic symbols.
 - a. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 5. Variable Component Materials: 8-inch Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
 - 6. Exposed Accessories: Half-size Sample of each accessory type.
 - 7. Full-size Samples, if approved, will be returned to Contractor for use in Project.
- C. Product Schedule: For room-identification signs.

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1.5 INFORMATIONAL SUBMITTALS

Qualification Data: For manufacturer.

Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

Installer Qualifications: Manufacturer of products.

1.8 FIELD CONDITIONS

Field Measurements: Verify locations of anchorage devices and embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

PRODUCTS

1.10 PERFORMANCE REQUIREMENTS

Accessibility Standard: Comply with applicable provisions in 2012 Texas Accessibility Standards.

1.11 ROOM-IDENTIFICATION SIGNS

Room-Identification Sign: with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

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1. **Building** Image Group, 1200 E 3rd St, Austin, TX 78702, (512) 494-1466.
 - a. Surface-Applied Graphics: Raised.
 - b. Subsurface Graphics: Reverse etch image.
 - c. Color(s): As selected by Architect from manufacturer's full range.
2. Frame:
 - a. Material: Aluminum.
 - b. Material Thickness: 1/4".
 - c. Profile: Raised letters, symbols.
 - d. Finish and Color: Match Architect's sample.
3. Mounting: Surface mounted to wall with concealed anchors.
4. Text and Typeface: Accessible raised characters and Braille typeface matching Architect's sample and variable content. Finish raised characters to contrast with background color, and finish Braille to match background color.

1.12 SIGN MATERIALS

Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

1.13 ACCESSORIES

Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
 - b. Fastener Heads: Use oval countersunk screws and bolts with tamper-resistant Allen-head one-way-head slots unless otherwise indicated.
4. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
 - b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

1.14 FABRICATION

General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

1.15 GENERAL FINISH REQUIREMENTS

Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.16 ALUMINUM FINISHES

Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

EXECUTION

1.17 INSTALLATION

General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

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2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard 2012 TAS.

Mounting Methods:

4. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
5. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

1.18 ADJUSTING AND CLEANING

Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

Remove temporary protective coverings and strippable films as signs are installed.

On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23.13

SECTION 10 21 13.17 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.
2. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of centerlines of toilet fixtures.
3. Show locations of floor drains.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

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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. Door Hinges: 8 hinge(s) with associated fasteners.
 2. Latch and Keeper: 8 latch(es) and keeper(s) with associated fasteners.
 3. Door Bumper: 8 door bumper(s) with associated fasteners.
 4. Door Pull: 8 door pull(s) with associated fasteners.
 5. Fasteners: 15 fasteners of each size and type.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in [the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities] [and] [ICC A117.1] for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARTMENTS

- 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. Basis of Design: Wilsonart, D92 Dove Gray
- B. Toilet-Enclosure Style: Floor mounted, overhead braced.
- C. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch-thick doors and pilasters and minimum 1/2-inch-thick panels.

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D. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

E. Phenolic-Panel Finish:

1. Facing Sheet Finish: One color and pattern in each room.
2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.
3. Edge Color: Through-color matching facing sheet color.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's minimum 0.062-inch-thick stainless-steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through-bolts.
2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.
5. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- B. Stainless-Steel Castings: ASTM A 743/A 743M.

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2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Wall-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Wall-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.

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3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.17

SECTION 10 28 00 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Public-use shower room accessories.
 - 3. Underlavatory guards.

1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
 - 4. Approved full-size Samples will be returned and may be used in the Work.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify accessories using designations indicated.

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1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Roll) Dispenser: See Accessories Schedule on Drawings
- C. Grab Bar: See Accessories Schedule on Drawings
 - 1. Mounting: Flanges with concealed fasteners.
 - 2. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 - 3. Outside Diameter: As Indicated on Drawings.
 - 4. Configuration and Length: As indicated on Drawings.
- D. Mirror Unit: See Accessories Schedule on Drawings
 - 1. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

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- a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
- 2. Size: As indicated on Drawings.
- E. Towel Hook: See Accessories Schedule on Drawings

2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

- A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.

2.4 UNDERLAVATORY GUARDS

- A. Underlavatory Guard:
 - 1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
 - 2. Material and Finish: Antimicrobial, molded plastic, white.

2.5 CUSTODIAL ACCESSORIES

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
- B. Utility Shelf/Mop and Broom Holder: See Accessories Schedule on Drawings

2.6 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. 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.

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- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 10 44 16 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches square.
- D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

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1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.6 SEQUENCING

- A. Apply decals on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Larsens Manufacturing Company.
 - c. Nystrom, Inc.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Cabinet Trim Material: Steel sheet.
- F. Door Material: Steel sheet.
- G. Door Style: Center glass panel with frame.
- H. Door Glazing: Wire glass.

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- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting lever handle with cam-action latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - 3. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 - 4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Etched.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
 - 5. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries.
 - 6. Extinguisher Bracket for Chases: B2-10. Surface mounted.

- K. Materials:
 - 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities.
 - 2. Wire Glass: ASTM C 1036, Type II, Class 1, Form 1, Quality q8, Mesh m1 (diamond), 6 mm thick.
 - 3.

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

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1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

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3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Fire-Protection Cabinets: 54 inches above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers
- B. Related Requirements:
 - 1. Section 10 44 13 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

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1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 - 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Larsens Manufacturing Company.
 - c. Nystrom, Inc.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type: UL-rated 2.5 lb. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 10 44 16

SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

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. Sleeves.
 - 2. Sleeve-seal fittings.
 - 3. Grout.

PART 2 - PRODUCTS

2.01 SLEEVES

- A. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

2.02 SLEEVE-SEAL 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:
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.03 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.

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- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. 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.
- C. 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 92 00 "Joint Sealants."

3.02 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:

-
- Issued for Regulatory Approval, Permitting, or Construction.
1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Sleeve-seal fittings.
 2. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: PVC-pipe sleeves.
 3. Interior Partitions:
 - a. Piping Smaller Than NPS 6: PVC-pipe sleeves.

END OF SECTION 22 05 17

SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING

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. Escutcheons.

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.01 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.

- Issued for Regulatory Approval, Permitting, or Construction.
- b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

END OF SECTION 22 05 18

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

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. Brass ball valves.
 - 2. Bronze ball valves.
- B. Related Sections:
 - 1. Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
 - 2. Section 22 11 16 "Domestic Water Piping" for valves applicable only to this piping.
 - 3. Section 22 13 19 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.

1.03 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

Issued for Regulatory Approval, Permitting, or Construction.

1.05 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.06 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 angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and 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.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Grooved: With grooves according to AWWA C606.
 - 3. Threaded: With threads according to ASME B1.20.1.
- E. Valve Bypass and Drain Connections: MSS SP-45.

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2.02 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nibco
 - b. Milwaukee
 - c. Apollo
2. 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 or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

B. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nibco
 - b. Milwaukee
 - c. Apollo
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Three piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.03 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nibco
 - b. Milwaukee
 - c. Apollo

2. 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 or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

B. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nibco
 - b. Milwaukee
 - c. Apollo

2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Three piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

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PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 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.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are not available, 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 below.

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3.05 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Ball Valves: Two piece, full port, brass or bronze with stainless-steel trim.
2. Bronze Swing Check Valves: Class 125, nonmetallic disc.

END OF SECTION 22 05 23

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.

B. Related Sections:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 22 05 48.13 "Vibration Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 PERFORMANCE REQUIREMENTS

- A. 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.

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1.05 ACTION SUBMITTALS

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

1.06 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

2.01 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.

2.02 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.

2.03 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 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:
 - 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - 3. Standard: MFMA-4.
 - 4. Channels: Continuous slotted steel channel with inturred lips.
 - 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

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6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dipped galvanized.
8. Paint Coating: Epoxy.
9. Plastic Coating: PVC.

2.04 THERMAL-HANGER SHIELD INSERTS

- 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. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psi minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psi minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-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.

2.06 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.

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PART 3 - EXECUTION

3.01 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. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. 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.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. 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.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

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- K. 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.
- L. 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.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

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- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; 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.

3.04 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.

3.05 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 91 23 "Interior Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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3.06 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, metal trapeze pipe hangers, and metal framing systems 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 Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 4. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 5. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. 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.

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- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 4. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 2. 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 22 05 29

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Brady or comparable product by one of the following:
 - a. Seton
 - 3. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 4. Letter Color: White.
 - 5. Background Color: Black.
 - 6. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 7. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

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8. 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.
 9. Fasteners: Stainless-steel self-tapping screws.
 10. 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.

2.02 PIPE LABELS

- 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. Basis-of-Design Product: Subject to compliance with requirements, provide Brady or comparable product by one of the following:
1. Seton
- C. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- F. 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.

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2.03 VALVE TAGS

- 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. Basis-of-Design Product: Subject to compliance with requirements, provide Brady or comparable product by one of the following:
 - 1. Seton
- C. Valve Tags: 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.
- D. 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.

PART 3 - EXECUTION

3.01 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.

3.02 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.

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3.03 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified in Section 09 91 23 "Interior Painting."
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. 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: White.

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3.05 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: 2 inches, round.
 - b. Hot Water: 2 inches, round.

 - 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.

END OF SECTION 22 05 53

SECTION 22 07 19 - PLUMBING PIPING INSULATION

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 insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Domestic recirculating hot-water piping.
- B. Related Sections:
 - 1. Section 22 07 16 "Plumbing Equipment Insulation."

1.03 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).

1.04 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.

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- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

- 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.05 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.

1.06 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 "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.
- C. Coordinate installation and testing of heat tracing.

1.07 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

2.01 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.

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- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Mineral-Fiber, Preformed Pipe Insulation:
 - 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. Owens Corning
 - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.03 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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- D. PVC Jacket Adhesive: Compatible with PVC jacket.

2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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- 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 permats 43-mildry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.

- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 permats 35-mildry film thickness.
 - 2. Service Temperature Range: 0 to 180 deg F.
 - 3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 - 4. Color: White.

- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 permats 30-mildry film thickness.
 - 2. Service Temperature Range: Minus 50 to plus 220 deg F.
 - 3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 - 4. Color: White.

- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 permsat 0.0625-inchdry 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.

2.05 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.

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3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

2.06 SEALANTS

A. Joint Sealants:

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.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC 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: White.

2.07 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. 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.

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2.08 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch width.
 - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Width: 2 inches.
 - 2. Thickness: 6 mils.
 - 3. Adhesion: 64 ounces force/inch width.
 - 4. Elongation: 500 percent.
 - 5. Tensile Strength: 18 lbf/inch width.

2.09 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inchthick, 1/2 inch wide with wing seal.
 - 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inchthick, 1/2 inch wide with wing seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.062-inchsoft-annealed, stainless steel.

PART 3 - EXECUTION

3.01 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.

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3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 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.

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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. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. 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.

3.04 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.05 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

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- 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.

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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.

3.06 INSTALLATION OF CELLULAR-GLASS 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:

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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.

3.07 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe 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 surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, 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 mineral-fiber blanket 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.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

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1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.08 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.09 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 91 13 "Exterior Painting" and Section 09 91 23 "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. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. 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

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strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 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.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. NPS 1 and Smaller: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - 2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
 - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

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- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. PVC: 20 mils thick.
- D. Piping, Exposed:
 - 1. PVC: 20 mils thick.

END OF SECTION 22 07 19

SECTION 22 11 16 - DOMESTIC WATER PIPING

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. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.03 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

PART 2 - PRODUCTS

2.01 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. Plastic piping components shall be marked with "NSF-pw."

2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- D. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.

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3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

E. Appurtenances for Grooved-End Copper Tubing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic
2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:
 - a. Copper-tube dimensions and design similar to AWWA C606.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - e. Minimum Pressure Rating: 300 psig.

2.03 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.

2.04 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.

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PART 3 - EXECUTION

3.01 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 copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install domestic water piping level without pitch and plumb.
- D. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- F. 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.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- H. Install piping to permit valve servicing.
- I. 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.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

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- O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.02 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. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- H. 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.
- I. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
- J. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

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3.03 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 unions.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 "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 hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

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3.05 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. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 4. 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.

3.06 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.07 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.

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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.

3.08 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. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.09 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.

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- C. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

- D. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

END OF SECTION 22 11 16

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

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. Pipe, tube, and fittings.

1.03 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.

1.04 ACTION SUBMITTALS

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

1.05 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.

PART 2 - PRODUCTS

2.01 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.

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2.02 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
- D. Solvent Cement: ASTM D 2564.

PART 3 - EXECUTION

3.01 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 20 00 "Earth Moving."

3.02 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

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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 underground PVC piping according to ASTM D 2321.
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

- A. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

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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.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "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.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- 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.

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- H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.05 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 13 19 "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. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.06 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.07 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.

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- 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.

3.08 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 the following:
 - 1. 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 the following:

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1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Underground, soil and waste piping NPS 5 and larger shall be the following:
1. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.

END OF SECTION 22 13 16

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

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. Cleanouts.
 - 2. Floor drains.
 - 3. Roof flashing assemblies.
 - 4. Miscellaneous sanitary drainage piping specialties.
 - 5. Flashing materials.

1.03 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene plastic.
- D. PE: Polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

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- 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.

1.06 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."
- B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.01 CLEANOUTS

- A. Exposed Metal Cleanouts Refer to Plumbing Fixture Schedule on drawings.:
 - 1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 2. Size: Same as connected drainage piping
 - 3. Closure: Stainless-steel plug with seal.
- B. Metal Floor Cleanouts Refer to Plumbing Fixture Schedule on drawings.:
 - 1. ASME A112.36.2M, Cast-Iron Cleanouts:
 - 2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.
 - 3. Size: Same as connected branch.
 - 4. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- C. Cast-Iron Wall Cleanouts Refer to Plumbing Fixture Schedule on drawings.:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2. Standard: ASME A112.36.2M. Include wall access.
 - 3. Size: Same as connected drainage piping.
 - 4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Closure: Countersunk, brass plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

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8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.02 FLOOR DRAINS

A. Cast-Iron Floor Drains Refer to Plumbing Fixture Schedule on drawings:

1. Standard: ASME A112.6.3.
2. Pattern: Floor drain.
3. Body Material: Gray iron.
4. Outlet: Bottom.

2.03 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies.:

1. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch-thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - a. Open-Top Vent Cap: Without cap.
 - b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.04 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Sleeve Flashing Device.:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

B. Stack Flashing Fittings.:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

C. Vent Caps.:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

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2.05 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: 4.0-lb/sq. ft., 0.0625-inch thickness.
 - 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 - 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- C. Fasteners: Metal compatible with material and substrate being fastened.
- D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- E. Solder: ASTM B 32, lead-free alloy.
- F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 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 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. 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.

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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 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.
 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.
- E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
 - F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
 - G. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
 - H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
 - I. Install vent caps on each vent pipe passing through roof.
 - J. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
 - K. Install wood-blocking reinforcement for wall-mounting-type specialties.
 - L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS

- A. Comply with requirements in Section 22 13 16 "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.
- C. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

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3.03 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 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Set flashing on floors and roofs in solid coating of bituminous cement.
- C. Secure flashing into sleeve and specialty clamping ring or device.
- D. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 07 62 00 "Sheet Metal Flashing and Trim."
- E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- F. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.04 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 05 53 "Identification for Plumbing Piping and Equipment."

3.05 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 13 19

SECTION 22 33 00 - ELECTRIC, 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, electric, storage, domestic-water heaters.
 - 2. Domestic-water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

1.4 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

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1.7 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: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: 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.
- 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."

1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, 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, Electric, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: Three years.
 - b. Compression Tanks: 3 years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, undefined:

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- a. A. O. Smith Corporation.
 - b. Rheem Manufacturing Company.
 - c. State Industries.
 - d. Bradford White
2. Standard: UL 1453.
 3. Storage-Tank Construction:ASME-code, steel vertical arrangement.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.
 4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1.
 - d. Jacket: Steel with enameled finish.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. 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.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. State Industries.

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2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
 4. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: 4 gal. minimum.
 - c. Air Precharge Pressure: .
- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- C. Heat-Trap Fittings: ASHRAE 90.2.
- D. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. 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.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect 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. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

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PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 2. Maintain manufacturer's recommended clearances.
 3. Arrange units so controls and devices that require servicing are accessible.
 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 8. Anchor domestic-water heaters to substrate.
- B. Residential, Electric, Domestic-Water Heater Mounting: Install residential, electric, domestic-water heaters on floor.
1. Maintain manufacturer's recommended clearances.
 2. Arrange units so controls and devices that require servicing are accessible.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Anchor domestic-water heaters to substrate.
- C. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping," Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing Piping."

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- D. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Domestic Water Piping Specialties."
- G. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- H. Fill electric, domestic-water heaters with water.
- I. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

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3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.
 - C. Prepare test and inspection reports.

END OF SECTION 22 33 00

SECTION 22 41 00 - PLUMBING FIXTURES

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. Lavatories.
 - 2. Showers.
 - 3. Water closets.
 - 4. Toilet seats.

1.03 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.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For plumbing fixtures and faucets to include in emergency, operation, and operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 LAVATORIES

- A. Lavatories Refer to Plumbing Fixture Schedule on drawings.: Oval, vitreous china, counter mounted.
 - 1. Vitreous-China Lavatories:

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- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Refer to Plumbing Fixture Schedule on drawings.

- 2. Fixture:

- a. Standard: ASME A112.19.2/CSA B45.1 for vitreous-china lavatories.

2.02 SHOWERS

A. Showers Refer to Plumbing Fixture Schedule on drawings.: Standard

- 1. Standard: ANSI Z124.1.2.

2.03 WATER CLOSETS

A. Water Closets Refer to Plumbing Fixture Schedule on drawings..

- 1. Bowl:

- a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.

2.04 TOILET SEATS

A. Toilet Seats Refer to Plumbing Fixture Schedule on drawings.:

- 1. Standard: IAPMO/ANSI Z124.5.

2.05 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.

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PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing-fixture installation.
- B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install plumbing fixtures level and plumb according to roughing-in drawings.
- B. Install floor-mounted water closets on closet flange attachments to drainage piping.
- C. Install counter-mounting fixtures in and attached to casework.
- D. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Comply with valve requirements specified in Section 22 05 23 "General-Duty Valves for Plumbing Piping."
- E. Install toilet seats on water closets.
- F. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- G. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes unless otherwise indicated.
- H. Set shower receptors in leveling bed of cement grout.
- I. 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 05 18 "Escutcheons for Plumbing Piping."
- J. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture

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color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.03 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 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

- A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.
- B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed plumbing fixtures and fittings.
- D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 41 00

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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 general requirements for single-phase and poly phase, 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.

1.03 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

2.01 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C 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.

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2.03 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 48.13 - VIBRATION CONTROLS FOR HVAC

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. Spring hangers.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.04 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

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PART 2 - PRODUCTS

2.01 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 VIBRATION CONTROL DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 Cast-in-Place Concrete.

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- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 23 05 48.13

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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. Equipment labels.
 - 2. Stencils.

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements.
 - 2. Material and Thickness: Brass, 0.032-inch, stainless steel, 0.025-inch, aluminum, 0.032-inch, or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 3. Letter Color: Black
 - 4. Background Color: Red or White
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

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- 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.

2.02 STENCILS

- A. Stencils for Ducts:
 - 1. Manufacturers: Subject to compliance with requirements:
 - 2. 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.
 - 3. Stencil Material: Fiberboard
 - 4. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
 - 5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
- B. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:
 - 1. Manufacturers: Subject to compliance with requirements:
 - 2. Lettering Size: Minimum letter height of 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
 - 3. Stencil Material: Fiberboard
 - 4. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
 - 5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.

PART 3 - EXECUTION

3.01 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.

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3.02 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.

3.03 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.04 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- 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 25 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 23 05 53

SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

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. This Section includes control sequences for HVAC systems, subsystems, and equipment.

1.03 DEFINITIONS

- A. DDC: Direct digital control.

1.04 VENTILATION SEQUENCES

- A. Exhaust Fan: Interlock and controlled with switch / timer switch. Refer to plans.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 09 93

SECTION 23 31 13 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
 - 2. Sheet metal materials.
 - 3. Sealants and gaskets.
 - 4. Hangers and supports.
- B. Related Sections:
 - 1. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" ASCE/SEI 7.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Adhesives.
 - 2. Sealants and gaskets.
- B. Shop Drawings:

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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, 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. Equipment installation based on equipment being used on Project.
10. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.05 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. Perimeter moldings.
- B. Welding certificates.

1.06 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports, AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. 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.

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- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 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."

2.02 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: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

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- D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- E. 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.

2.03 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. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
- C. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.04 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.

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- 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.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.01 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.

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- K. 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."

3.02 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.

3.03 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."

3.04 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.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and

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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.

3.05 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 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. Test the following systems:
 - a. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 4. Test for leaks before applying external insulation.
 - 5. 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.
 - 6. Give seven days' advance notice for testing.
- C. Duct system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

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3.07 DUCT SCHEDULE

A. 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."

END OF SECTION 23 31 13

SECTION 23 33 00 - AIR DUCT ACCESSORIES

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. Backdraft dampers.
 - 2. Flexible connectors.
 - 3. Duct accessory hardware.
- B. Related Requirements:
 - 1. Section 23 37 23 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.

1.03 ACTION SUBMITTALS

- A. 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. Wiring Diagrams: For power, signal, and control wiring.

PART 2 - PRODUCTS

2.01 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."

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- 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.

2.02 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 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.

2.03 BACKDRAFT DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product ct to compliance with requirements, or comparable product by one of the following:
 - 1. Ruskin
 - 2. Greenheck
 - 3. Nailor
- C. Description: Gravity balanced.
- D. Maximum Air Velocity: 1250 fpm.
- E. Maximum System Pressure: 2-inch wg.
- F. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded corners or mechanically attached.
- G. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.
- H. Blade Action: Parallel.
- I. Blade Seals: Felt.

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- J. Blade Axles:
 - 1. Material: Stainless steel.
 - 2. Diameter: 0.20 inch.
- K. Tie Bars and Brackets: Aluminum.
- L. Return Spring: Adjustable tension.
- M. Bearings: Steel ball.
- N. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Screen Material: Galvanized steel.
 - 4. Screen Type: Bird.

2.04 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements:
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 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.
- 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.

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2.05 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

3.01 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. Install backdraft at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
- G.
 - 1. 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.
 - 2. Control devices requiring inspection.
 - 3. Elsewhere as indicated.
- H. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- I. Install duct test holes where required for testing and balancing purposes.

3.02 FIELD QUALITY CONTROL

- A. Tests and Inspections:

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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.

END OF SECTION 23 33 00

SECTION 23 34 16 - CENTRIFUGAL HVAC FANS

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: For each product.
 - 1. Backward-inclined centrifugal fans.

1.03 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.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Belts: One set(s) for each belt-driven unit.

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PART 2 - PRODUCTS

2.01 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.
 - 1. Vibration Isolators: Spring isolators having a static deflection of 1 inch.

2.02 BACKWARD-INCLINED CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, or a comparable product by one of the following:
 - 1. Greenheck
 - 2. Cook
 - 3. Twin City Fans
- C. 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.
- D. 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. Spun inlet cone with flange.
 - 4. Outlet flange.
- E. Backward-Inclined Wheels:

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1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades, and fastened to shaft with set screws.
2. Welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate.

F. 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.

G. Prelubricated and Sealed Shaft Bearings:

1. Self-aligning, pillow-block-type ball bearings.
2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000.

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. Companion Flanges: Rolled flanges for duct connections of same material as housing.

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2.03 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

2.04 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

3.01 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. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation devices specified in Section 23 05 48.13 "Vibration Controls for HVAC."
- E. Unit Support: Install centrifugal fans level. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.
- F. Install units with clearances for service and maintenance.
- G. Label fans according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.02 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 33 00 "Air Duct Accessories."

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- B. Install ducts adjacent to fans to allow service and maintenance.

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 23 34 16

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

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. Adjustable bar registers and grilles.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 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, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.01 DIFFUSERS / GRILLES

- A. Refer to schedule on plans.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Titus, Price, Krueger, Nailor

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 26 05 23 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.
 - 2. Section 27 15 00 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.03 ACTION SUBMITTALS

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

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.

1.05 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.

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PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

- 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. Basis-of-Design Product: Subject to compliance with requirements, provide Service Wire or comparable product by one of the following:
 - 1. Alpha Wire Company.
 - 2. Southwire Company.
 - 3. Thomas & Betts Corporation; A Member of the ABB Group.
- C. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- D. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for, Type THHN-2-THWN-2,.

2.02 CONNECTORS AND SPLICES

- 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. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbel Power Systems or comparable product by one of the following:
- C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 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

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

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- 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.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.03 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 05 33 "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 05 29 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 26 05 36 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

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3.04 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 12 inches of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "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.

3.06 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 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 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 with the assistance of a factory-authorized service representative:
 - 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.
 - 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

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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.
- C. 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.
- D. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 05 19

SECTION 26 05 23 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

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. Low-voltage control cabling.
 - 2. Control-circuit conductors.
 - 3. Identification products.

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.
- D. RCDD: Registered Communications Distribution Designer.
- E. UTP: Unshielded twisted pair.

1.04 ACTION SUBMITTALS

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

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

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1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 PERFORMANCE REQUIREMENTS

- A. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262 by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
 - 1. Flame Travel Distance: 60 inches or less.
 - 2. Peak Optical Smoke Density: 0.5 or less.
 - 3. Average Optical Smoke Density: 0.15 or less.
- B. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- C. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.03 BACKBOARDS

- A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Section 06 10 00 "Rough Carpentry."
- B. Painting: Paint plywood on all sides and edges with eggshell latex paint. Comply with requirements in Section 09 91 23 "Interior Painting."

2.04 LOW-VOLTAGE CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - 1. Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.

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2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.05 CONTROL-CIRCUIT CONDUCTORS

- 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. **Basis-of-Design Product:** Subject to compliance with requirements, provide Service Wire or comparable product by one of the following:
 1. General Cable; General Cable Corporation.
 2. Southwire Company.
- C. Class 1 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.
- D. Class 2 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.
- E. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.
- F. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.
 1. Smoke control signaling and control circuits.

2.06 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP cables according to TIA-568-C.2.
- C. Factory test optical-fiber cables according to TIA-568-C.3.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

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PART 3 - EXECUTION

3.01 EXAMINATION

- A. Test cables on receipt at Project site.
 - 1. Test optical-fiber cable to determine the continuity of the strand end to end. Use optical-fiber flashlight or optical loss test set.
 - 2. Test optical-fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 - 3. Test each pair of UTP cable for open and short circuits.

3.02 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
 - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
 - 2. Outlet boxes for optical-fiber cables shall be no smaller than 4 inches square by 2-1/8 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
 - 3. Flexible metal conduit shall not be used.
- B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.
- D. Raceway Installation in Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard if entering the room from overhead.
 - 4. Extend conduits 3 inches above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- E. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

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3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C Series of standards.
 - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems."
 - 3. Terminate all conductors and optical fibers; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 4. Cables may not be spliced.
 - 5. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
 - 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
 - 9. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Monitor cable pull tensions.
 - 10. Support: Do not allow cables to lay on removable ceiling tiles.
 - 11. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
- C. Installation of Control-Circuit Conductors:
 - 1. Install wiring in raceways. Comply with requirements specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- D. Optical-Fiber Cable Installation:
 - 1. Comply with TIA-568-C.3.
 - 2. Terminate cable on connecting hardware that is rack or cabinet mounted.
- E. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

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2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Below each feed point, neatly coil a minimum of 72 inches of cable in a coil not less than 12 inches in diameter.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches.

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- c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.04 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified for future use with a tag.

3.05 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
 1. Class 1 remote-control and signal circuits; No 14 AWG.
 2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
 3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.06 GROUNDING

- A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For low-voltage control wiring and cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.07 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- B. Identify data and communications system components, wiring, and cabling according to TIA-606-A; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

3.08 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

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1. Visually inspect UTP and optical-fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical-Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.0. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for links shall be less than 2.0 dB.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 26 05 23

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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 grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Foundation steel electrodes.

1.03 ACTION SUBMITTALS

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

1.04 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. Ground rods.
 - 2. Grounding arrangements and connections for separately derived systems.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

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- a. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NFPA 70B.
 - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - 2) Include recommended testing intervals.

1.06 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.
- 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 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:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Thomas & Betts or comparable product by one of the following:
 1. Burndy; Part of Hubbell Electrical Systems.
 2. ERICO International Corporation.
 3. O-Z/Gedney; a brand of Emerson Industrial Automation.

2.02 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.

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2.03 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes 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.

2.04 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.

2.05 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.01 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 tinned-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.

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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 Structural Steel: Welded connectors.

3.02 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.

3.03 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.04 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. 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.

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- F. **Metallic Fences:** Comply with requirements of IEEE C2.
 - 1. **Grounding Conductor:** Bare, tinned copper, not less than No. 8 AWG.
 - 2. **Gates:** Shall be bonded to the grounding conductor with a flexible bonding jumper.
 - 3. **Barbed Wire:** Strands shall be bonded to the grounding conductor.

3.05 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 Bonding Common with Lightning Protection System:** Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. **Ground Rods:** Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. **Bonding Straps and Jumpers:** Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. **Bonding to Structure:** Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. **Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports:** Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. 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.

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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 tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- H. 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.

3.06 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, 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

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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. 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 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.05 ACTION SUBMITTALS

- A. Product Data: For the following:

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1. Steel slotted support systems.
 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
1. Trapeze hangers. Include Product Data for components.
 2. Steel slotted channel systems. Include Product Data for components.
 3. Nonmetallic slotted channel systems. Include Product Data for components.
 4. Equipment supports.

1.06 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.07 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. These items are specified in Section 07 72 00 "Roof Accessories."

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 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:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. B-line, an Eaton business.
 - c. ERICO International Corporation.
 - d. G-Strut.
 - e. Thomas & Betts Corporation; A Member of the ABB Group; Metal Framing Channels.

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- f. Unistrut; Part of Atkore International.
 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 6. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch-diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
 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:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. B-line, an Eaton business.
 - c. G-Strut.
 - d. Haydon Corporation.
 3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 5. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. 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.
- E. 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.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

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1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. 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:
 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

3.01 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 required by NFPA 70. Minimum rod size shall be 1/4 inch diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other 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 two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 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.

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- 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.

3.03 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 91 13 "Exterior Painting", Section 09 91 23 "Interior Painting", and Section 09 96 00 "High Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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. Metal conduits, tubing, and fittings.
 - 2. Boxes, enclosures, and cabinets.

1.03 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. AFC Cable Systems; a part of Atkore International.
 - 2. Allied Tube & Conduit; a part of Atkore International.
 - 3. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
 - 5. Wheatland Tube Company.

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- 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. GRC: Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel or 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. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew or compression.
 - 3. 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.
 - 4. 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.

2.02 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.

2.03 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: 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. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Metal Floor Boxes:

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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.
- E. 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.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- H. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.
- I. Gangable boxes are prohibited.
- 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 3R 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.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

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- B. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- C. 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.
- D. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- E. Support conduit within 12 inches of enclosures to which attached.
- F. 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.
- G. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- I. 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.
- J. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- K. 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.
- L. 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.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- N. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius 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

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manufacturer's written instructions. Tape and glue are not acceptable support methods.

- O. 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.
- P. 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.
- Q. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- R. 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 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.

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- S. 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.
- T. 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.
- U. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- V. Locate boxes so that cover or plate will not span different building finishes.
- W. 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.
- X. Set metal floor boxes level and flush with finished floor surface.

3.02 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 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.03 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 05 33

SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 2. Sleeve-seal systems.
 3. Sleeve-seal fittings.
 4. Grout.
 5. Silicone sealants.

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 SLEEVES

- A. Wall Sleeves:
1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

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- D. Sleeves for Rectangular Openings:
1. Material: Galvanized sheet steel.
 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Carbon steel.
 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2.04 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.

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2.05 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

3.01 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 92 00 "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.
 - 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. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

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- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.03 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.04 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.

1.05 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

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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.

PART 2 - PRODUCTS

2.01 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.
- D. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.02 ARMORED AND METAL-CLAD CABLE 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 and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

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- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.03 POWER AND CONTROL CABLE 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 and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.04 CONDUCTOR IDENTIFICATION MATERIALS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.05 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. 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."

2.06 INSTRUCTION SIGNS

- 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.

2.07 EQUIPMENT IDENTIFICATION LABELS

- A. 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.

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2.08 CABLE TIES

- A. 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.

2.09 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 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. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-footmaximum intervals in straight runs, and at 25-footmaximum intervals in congested areas.
- G. 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.
- H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

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3.02 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 30-foot maximum intervals.
- B. 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.
 - 3. UPS.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 203/110-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 403/117-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

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1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. 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.
- H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- J. 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: Engraved, laminated acrylic or melamine label. 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:

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- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
- b. Contactors.
- c. Receptacles, lighting switches and junction boxes (type written label with panel and circuit number)

END OF SECTION 26 05 53

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SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.
- B. Outdoor motion sensors.
- C. Time switches.
- D. Outdoor photo controls.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0537 - Boxes.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
 - 1. Includes finish requirements for wall controls specified in this section.
 - 2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.
- E. Section 26 5100 - Interior Lighting.
- F. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.
- E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 773 - Plug-in Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.
- G. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.
- H. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.
- I. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

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J. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements and 26 0200 - Basic Electrical Requirements, for submittal procedures.
- B. Prior Approval: If products from other than the named manufacturer are submitted in consideration for inclusion within the project, all of the following requirements must be met. Failure to meet any one of the following requirements will constitute failure to comply with the project requirements and the submitted package will not be considered for inclusion.
 1. Specifications Compliance: Submit a line-by-line comparison that describes the differences between each specifications requirement and the equipment / systems being proposed. Comparison shall include a complete listing of how the proposed equipment / systems differ from that specified with regard to size, quantity, quality, method of control, features and functions, control software functions and installation requirements.
 2. System Description: Supply as part of the submittal package a brief description of the lighting control system's major features and functions.
 3. Bill of Materials: Provide as part of the submittal package a detailed itemized listing, using the Engineer's project naming convention, of all proposed equipment, including quantities and capacities for all major system components.
 4. Product Data Sheets: Provide as part of the submittal package, detailed product data sheets, using the engineer's project naming convention, providing one individual product data sheet per each specified component, for all major system components.
 5. Warranty: Provide as part of the submittal package a complete written warranty.
 6. One-Line Diagram: Provide a one-line diagram showing all relay lighting control panels and devices connected to the lighting control system such as master relay panel, satellite relay panel(s), digital time clock, low voltage switches, bus boosters, network connectors, typical interconnection diagrams, etc.

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7. Lighting Controls Layouts: Provide lighting controls equipment and device layouts in *.pdf format, on the Architect's most current ceiling plans, using the same scale and text height as the engineering ceiling plans, for all spaces with location and model number of each device and system component clearly indicated in all spaces for evaluation of conformance to the design intent by the Engineer.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on construction, dimensions, ratings, finishes, features, mounting requirements, listings, service condition requirements, installed accessories, and standard wiring diagrams; include model number nomenclature clearly marked with all proposed features. Provide separate product data information for each lighting control device indicated using Engineer's project naming convention.
 1. Provide submittals for this Section concurrently with Sections 26 0918, 26 5100 and 26 5600.
 2. Arrange in order of device designation.
- D. One-Line Diagram: Provide a one-line diagram showing all relay lighting control panels and devices connected to the lighting control system such as master relay panel, satellite relay panel(s), digital time clock, low voltage switches, bus boosters, network connectors, typical interconnection diagrams, etc.
- E. Lighting Controls Layouts: Provide lighting controls equipment and device layouts in *.pdf format, on the Architect's most current ceiling plans, using the same scale and text height as the engineering ceiling plans, for all spaces with location and model number of each device and system component clearly indicated in all spaces.
- F. Operation and Maintenance Data: Include detailed information on device programming and setup.
- G. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide two year manufacturer warranty for all occupancy sensors.
- C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.

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- D. Provide two year manufacturer warranty for all daylighting controls.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

- A. Manufacturers:
 - 1. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. All Occupancy Sensors:
 - 1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
 - 2. Sensor Technology:
 - a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
 - b. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
 - c. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
 - 3. Provide LED to visually indicate motion detection.
 - 4. Operation: Unless otherwise indicated, occupancy sensor shall require a manual input to turn lighting load on, and will NOT automatically turn lighting load on when occupant presence is detected. Occupancy sensor shall turn on non-lighting loads, such as HVAC interface and controlled receptacles, when occupant presence is detected. Occupancy sensor will automatically turn all loads off when no occupant presence is detected during an adjustable turn-off delay time interval.
 - 5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
 - 6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
 - 7. Turn-Off Delay: Field adjustable, with time delay settings up to 20 minutes.
 - 8. Sensitivity: Field adjustable.
 - 9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
 - 10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.

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11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
 12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on the drawings.
 13. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
- C. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 - b. Unless otherwise indicated or required to control the load indicated on the drawings, provide low voltage units, for use with separate compatible accessory power packs.
 - c. Finish: White unless otherwise indicated.
 2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 3. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 4. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet.
- D. Accessories:
1. Provide heavy duty coated steel wire protective guards compatible with specified occupancy sensors where indicated.

2.03 OUTDOOR PHOTO CONTROLS

- A. Manufacturers:
1. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. Stem-Mounted Outdoor Photo Controls:
1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
 2. Housing: Weatherproof, impact resistant polycarbonate.
 3. Photo Sensor: Cadmium sulfide.
 4. Provide external sliding shield for field adjustment of light level activation.

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5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.
9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of lighting control devices provided under this section.
 1. Mounting Heights: as indicated in Section 26 2726.
 2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.

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- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.
- G. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- H. Identify lighting control devices in accordance with Section 26 0553.
- I. Occupancy Sensor Locations:
 - 1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
 - 2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- J. Outdoor Photo Control Locations:
 - 1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
 - 2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
- K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
- L. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
- M. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 0537 for mounting of lighting control device system components.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each lighting control device for damage and defects.
- C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- D. Test time switches to verify proper operation.
- E. Test outdoor photo controls to verify proper operation, including time delays where applicable.
- F. Correct wiring deficiencies and replace damaged or defective lighting control devices.

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3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.
- C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
- D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.
- F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
 - 3. Location: At project site.

END OF SECTION 062923

SECTION 26 24 16 - PANELBOARDS

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. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

1.04 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.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," 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.

1.07 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.
 - 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
 - 3. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.08 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.

1.09 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 NEMA PB 1.

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 23 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 Architect no fewer than two days in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without Owner's written permission.
 - 3. Comply with NFPA 70E.

1.11 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

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 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: Same finish as panels and trim.
 - 4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses:
 - 1. Material: Tin-plated aluminum.
 - 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: Tin-plated aluminum.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- 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.

2.02 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:
 - 1. General Electric Company: GE Industrial
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
 - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
- F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- 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. 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. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
3. 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.

2.05 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

3.01 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- 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.

3.02 INSTALLATION

- A. Install panelboards and accessories according to NECA 407 NEMA PB 1.1.
- B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete." Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
 2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to panelboards.
 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
 - D. Mount top of trim 90 inches above finished floor unless otherwise indicated.
 - E. 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.
 - F. Install overcurrent protective devices and controllers not already factory installed.
 - G. Install filler plates in unused spaces.
 - H. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
 - I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
 - J. Comply with NECA 1.

3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "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 05 53 "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 05 53 "Identification for Electrical Systems."

3.04 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.

3.05 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.

3.06 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Weather-resistant receptacles.
 - 3. Snap switches and wall-box dimmers.
 - 4. Solid-state fan speed controls.
 - 5. Communications outlets.
 - 6. Pendant cord-connector devices.
 - 7. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.03 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.
- E. UTP: Unshielded twisted pair.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.05 ACTION SUBMITTALS

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

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1.06 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.07 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

2.01 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Hubbell, Leviton, Pass & Seymour
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 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. All devices to be Decora Style.
- D. Apparatus Bay and Support Areas – all switch and outlet cover plates to be stainless steel.
- E. 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.

2.03 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.

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2.04 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.

2.05 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.06 RESIDENTIAL DEVICES

A. General: All devices to be Decora Style.

B. Residential-Grade, Tamper-Resistant Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.

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. Cooper; TR270.
 - b. Hubbell; RR155TR.
 - c. Leviton; T5320.
 - d. Pass & Seymour; TR62.
2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.

C. Fan Speed Controls:

1. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters.
2. Comply with UL 1917.

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3. Continuously adjustable slider, 5 A.

D. Telephone Outlet:

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. Cooper; 3560-6.
 - b. Leviton; 40649.
2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e (Verify with owner data cabling installer). Comply with UL 1863.

E. Combination TV and Telephone Outlet:

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. Cooper; 3562.
 - b. Leviton; 40159.
2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e (Verify with owner data cabling installer). Comply with UL 1863.

2.07 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.

2.08 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: Smooth, high-impact thermoplastic.
 3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.

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4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
 5. Material for Apparatus Bay and support areas: stainless steel.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.09 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, solid brass with satin finish.
- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in Section 27 15 00 "Communications Horizontal Cabling."

2.10 FINISHES

- A. Device Color:
 1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Emergency Power System: Red.
 3. Isolated-Ground Receptacles: Orange.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.01 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.

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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 inches in 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:

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1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
 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, multi-gang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.03 IDENTIFICATION

- A. Comply with Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each receptacle and switch 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.

3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
 2. Test Instruments: Use instruments that comply with UL 1436.
 3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

Issued for Regulatory Approval, Permitting, or Construction.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

- C. Test straight-blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 OZ..
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 26 27 26

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SECTION 26 5100 - INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Ballasts and drivers.
- C. Lamps.
- D. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0537 - Boxes.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.
- D. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.
- E. Section 26 5113 - Luminaires, Ballasts, and Drivers - Lutron: Additional lighting products.
- F. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; Illuminating Engineering Society; 2002 (Reaffirmed 2008).
- B. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.
- C. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- E. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.
- F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.
- G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; National Electrical Manufacturers Association; 2011.
- H. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2012.

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- I. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 101 - Life Safety Code; National Fire Protection Association; 2015.
- K. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- L. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- M. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Coordinate the placement of exit signs with the local AHJ's requirements, furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
 - 4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements and Section 26 0200 - Basic Electrical Requirements, for submittal procedures.
- B. Prior Approval: If luminaires other than the named product are submitted in consideration for inclusion within the project, all of the following requirements must be met. Failure to meet any one of the following requirements will constitute failure to comply with the project requirements and the submitted package will not be considered for inclusion.
 - 1. Specifications Compliance: Submit a line-by-line comparison that describes the differences between each specifications requirement and the equipment / systems being proposed. Comparison shall include a complete listing of how the proposed equipment / systems differ from that specified with regard to size, quantity, quality, method of control, features and functions, control software functions and installation requirements.
 - 2. System Description: Where luminaires are specified with integral controls, supply as part of the submittal package a brief description of the lighting control system's major features and functions.
 - 3. Bill of Materials: Provide as part of the submittal package a detailed itemized listing, using the Engineer's project naming convention, of all proposed equipment, including quantities and capacities for all major system components.

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4. **Product Data Sheets:** Provide as part of the submittal package, detailed product data sheets, using the engineer's project naming convention, providing one individual product data sheet per each specified component, for all major system components.
5. **Warranty:** Provide as part of the submittal package a complete written warranty.
6. **Photometric Calculations:** Due to the difference in performance in fixtures between manufacturers, if luminaires other than the Basis of Design luminaires as indicated within the Luminaire Schedule are submitted for approval, provide in *.pdf format, ceiling plans for all spaces indicated below with the Architect's current backgrounds, using the same scale and text height as the engineering ceiling plans, with point-by-point, full radiosity illuminance calculations in a 2'x2' calculation point grid to two decimal places, electronic copy of all *.ies files with an individual *.ies file for each luminaire using the engineer's project naming convention, room or space height and/or ceiling height used in the calculations with height clearly indicated for all calculated spaces, complete interior space-by-space calculation summary table for all calculated spaces with each space name clearly indicated using Architects room number and room name separated by a hyphen, calculation plane height, light loss factor, initial lumens, and mounting height clearly indicated for all luminaires and spaces for evaluation of accuracy and conformance to the design intent by the Engineer.
 - a. Provide Photometric Calculations for the following spaces: provide photometrics for all typical spaces.
- C. **Samples:** Engineer may request the vendor provide sample(s) of lighting fixture(s) to review.
- D. **Shop Drawings:**
 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- E. **Product Data:** Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features. Provide separate product data information for each luminaire indicated using Engineer's project naming convention.
 1. Provide submittals for this Section concurrently with Sections 26 0923, 26 0918 and 26 5600.
 2. Arrange in order of luminaire designation.
 3. **LED Luminaires:**
 - a. Include estimated useful life, calculated based on IES LM-80 test data upon request.
 - b. Include IES LM-79 test report upon request.
- F. **Operation and Maintenance Data:** Instructions for each product including information on replacement parts.
- G. **Maintenance Materials:** Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 - Product Requirements, for additional provisions.

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2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
- H. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for all LED luminaires, including drivers.
- C. Provide five year pro-rata warranty for batteries for emergency lighting units.
- D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Basis-of-Design Product: The design for each lighting fixture is based on the product as indicated in Interior Luminaire Schedule included on the drawings. Subject to compliance with requirements, provide either the named product or a comparable product as approved by the Engineer. Reference Prior Approval requirements under SUBMITTALS for luminaires other than the named basis-of-design product. All substitution requests shall be submitted 11 business days prior to bid.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

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- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- H. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
 - 4. In Interior Luminaire Schedule, where lumens is indicated, the product shall be within 10% of the value indicated for the basis-of-design fixture.
 - 5. In Interior Luminaire Schedule, where CCT is indicated, the product shall be within 100 K of the value indicated for the basis-of-design fixture.
 - 6. In Interior Luminaire Schedule, where CRI is indicated, the product shall be not less than the value indicated for the basis-of-design fixture.
 - 7. In Interior Luminaire Schedule, where Input VA is indicated, the product shall be not more than the value indicated for the basis-of-design fixture.

2.03 BALLASTS AND DRIVERS

- A. Ballasts - General Requirements:
 - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- B. Dimmable LED Drivers:
 - 1. Dimming Range: Continuous dimming from 100 percent to ten percent relative light output unless dimming capability to lower level is indicated, without flicker.
 - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.
 - a. Wall Dimmers: See Section 26 2726.
 - b. Daylighting Controls: See Section 26 0923.

2.04 LAMPS

- A. Manufacturers:
 - 1. General Electric Company/GE Lighting: www.gelighting.com.
 - 2. Osram Sylvania: www.sylvania.com.
 - 3. Philips Lighting Company: www.lighting.philips.com.
 - 4. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.

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5. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.
- B. Lamps - General Requirements:
1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

2.05 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.06 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.

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- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- F. Install accessories furnished with each luminaire.
- G. Bond products and metal accessories to branch circuit equipment grounding conductor.
- H. Identify luminaires connected to emergency power system in accordance with Section 26 0553.
- I. Install lamps in each luminaire.
- J. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.05 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 - Identification for Electrical Systems.

3.06 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.07 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.08 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.09 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

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- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
- D. Just prior to Substantial Completion, replace all lamps that have failed.

3.10 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265100

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SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0537 - Boxes.
- C. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.
- D. Section 26 5100 - Interior Lighting.

1.03 REFERENCE STANDARDS

- A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.
- B. IEEE C2 - National Electrical Safety Code; Institute of Electrical and Electronic Engineers; 2012.
- C. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; Institute of Electrical and Electronic Engineers; 2002 (Cor 1, 2012).
- D. IESNA LM-5 - Photometric Measurements of Area and Sports Lighting Installations; Illuminating Engineering Society; 2004 (Reaffirmed 2007).
- E. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; Illuminating Engineering Society; 2002 (Reaffirmed 2008).
- F. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.
- G. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- I. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; National Electrical Contractors Association; 2006.
- J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2012.
- K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1598 - Luminaires; Current Edition, Including All Revisions.

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- M. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products;
Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements and Section 26 0200 - Basic Electrical Requirements, for submittal procedures.
- B. Prior Approval: If luminaires other than the named product are submitted in consideration for inclusion within the project, all of the following requirements must be met. Failure to meet any one of the following requirements will constitute failure to comply with the project requirements and the submitted package will not be considered for inclusion.
1. Specifications Compliance: Submit a line-by-line comparison that describes the differences between each specifications requirement and the equipment / systems being proposed. Comparison shall include a complete listing of how the proposed equipment / systems differ from that specified with regard to size, quantity, quality, method of control, features and functions, control software functions and installation requirements.
 2. System Description: Where luminaires are specified with integral controls, supply as part of the submittal package a brief description of the lighting control system's major features and functions.
 3. Bill of Materials: Provide as part of the submittal package a detailed itemized listing, using the Engineer's project naming convention, of all proposed equipment, including quantities and capacities for all major system components.
 4. Product Data Sheets: Provide as part of the submittal package, detailed product data sheets, using the engineer's project naming convention, providing one individual product data sheet per each specified component, for all major system components.
 5. Warranty: Provide as part of the submittal package a complete written warranty.
 6. Photometric Calculations: Due to the difference in performance in fixtures between manufacturers, if luminaires other than the Basis of Design luminaires as indicated within the Luminaire Schedule are submitted for approval, provide in *.pdf format, a site plan with the Architect's and Civil Engineer's current backgrounds, using the same scale and text height as the engineering site plans, with point-by-point, direct radiosity illuminance calculations in a 10'x10' calculation point grid to two decimal places, electronic copy of all *.ies files with an individual *.ies file for each luminaire using the engineer's project naming convention, complete exterior space-by-space calculation summary table for all calculation areas with each area name clearly indicated using Engineer's naming project convention, calculation plane height, light loss factor, initial lumens, and mounting height clearly indicated for all luminaires for evaluation of accuracy and conformance to the design intent by the Engineer.

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- a. Provide Photometric Calculations for the following spaces: provide outdoor lighting photometrics for the entire project site.
- C. Samples: Engineer may request the vendor provide sample(s) of lighting fixture(s) to review.
- D. Shop Drawings:
 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 2. Provide structural calculations for each pole proposed for substitution.
- E. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
 1. Provide submittals for this Section concurrently with Sections 26 0923, 26 0918 and 26 5600.
 2. Arrange in order of luminaire designation.
 3. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - b. Include IES LM-79 test report upon request.
- F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
- H. Project Record Documents: Record actual connections, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.
- C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

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- B. Provide five year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Basis-of-Design Product: The design for each lighting fixture is based on the product as indicated in Exterior Luminaire Schedule included on the drawings. Subject to compliance with requirements, provide either the named product or a comparable product as approved by the Engineer. Reference Prior Approval requirements under SUBMITTALS for luminaires other than the named basis-of-design product. All substitution requests shall be submitted 11 business days prior to bid.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- H. Recessed Luminaires:
1. Ceiling Compatibility: Comply with NEMA LE 4.
 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- I. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
 2. Tested in accordance with IES LM-79 and IES LM-80.
 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
 4. In Exterior Luminaire Schedule, where lumens is indicated, the product shall be within 10% of the value indicated for the basis-of-design fixture.
 5. In Exterior Luminaire Schedule, where CCT is indicated, the product shall be within 100 K of the value indicated for the basis-of-design fixture.
 6. In Exterior Luminaire Schedule, where CRI is indicated, the product shall be not less than the value indicated for the basis-of-design fixture.
 7. In Exterior Luminaire Schedule, where Input VA is indicated, the product shall be not more than the value indicated for the basis-of-design fixture.

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- J. Exposed Hardware: Stainless steel.

2.03 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and factory-tested luminaire before shipping. Match finish process and color of pole or support materials where indicated.
- C. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.

2.05 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean and repair luminaires used for temporary lighting.

3.03 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

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3.04 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- F. Install accessories furnished with each luminaire.
- G. Bond products and metal accessories to branch circuit equipment grounding conductor.
- H. Install lamps in each luminaire.

3.05 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.06 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 - Identification for Electrical Systems.

3.07 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.08 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.09 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.10 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.

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- C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
- D. Just prior to Substantial Completion, replace all lamps that have failed.

3.11 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265600