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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Project information.
   2. Work covered by Contract Documents.

B. Bid Alternates
   1. Add Alternate#1 - Add data drop.
   2. Add Alternate#2 - Add an eye wash station.
   3. Add Alternate#3 - Add through-wall AC unit.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Scope of Work is defined by the Contract Documents and consists of the interior renovations of the existing bathhouse which includes full demolition of interior partitions and fixtures and MEP systems. Roof will not be touched.

This section describes the Project in general and provides an overview of the extent of the Work to be performed by the CONTRACTOR. Detailed requirements and extent of Work is stated in the applicable Specification Sections and shown on the Drawings. CONTRACTOR shall, except as otherwise specifically stated herein or in any applicable part of these Contract Documents, provide and pay for all labor, materials, equipment, tools, construction equipment, and other facilities and services necessary for proper execution, testing, and completion of the Work.

B. Any part or item of the Work which is reasonably implied or normally required to make the installation satisfactorily operable shall be performed by the CONTRACTOR and the expense thereof shall be included in the applicable unit prices or lump sum prices bid for the Work. It is the intent of these Specifications to provide the OWNER with the complete system. All miscellaneous appurtenances and other items of Work that are incidental to meeting the intent of the Specifications shall be considered as having been included in the applicable unit prices or lump sum prices bid for the Work even though these appurtenances and items may not be specifically called for in the Bid Documents.

C. The Work shall include furnishing all tools, labor, materials, equipment, and miscellaneous items necessary for the complete construction of the project.

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

1.4 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
SECTION 024119 - SELECTIVE DEMOLITION

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, but not limited to:
      1. Removal of exterior metal gates as shown on drawings.
      2. Removal of interior walls, doors and appurtenances.
      3. Removal of existing concrete slab only at shower floor area.
      4. Removal of MEP systems.
      5. Existing roof to remain.
      6. No site work is included in this scope of work.
      7. Salvage of existing items to be reused or recycled by owner.

1.3 MATERIALS OWNERSHIP
   A. Unless otherwise indicated, demolition waste becomes property of Contractor.
   B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstone walls and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
      1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 INFORMATIONAL SUBMITTALS
   A. Pre-demolition Photographs or Video: Submit to Architect and Owners for approval before Work begins.

1.5 FIELD CONDITIONS
   A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
   C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
      1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
   D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
B. Burning: Do not burn demolished materials.
C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 024119
SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including Uniform General and Supplementary Conditions and other Division-1 Specification sections, apply to this section.

1.2 SUMMARY

A. This section includes the following metal fabrications:
   1. Rough hardware.
   2. Grout.
   3. Miscellaneous framing and supports.
   4. Concrete panel lintels.
   5. Applications where framing and supports are not specified in other sections.
   6. See Sheets A100 and A502 for location of work.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Product data for products used in miscellaneous metal fabrications, including paint products and grout.
C. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.

1.4 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
B. Steel Plates, Shapes, and Bars: ASTM A 36.
E. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported items.

F. Steel Plates, Shapes, and Bars: ASTM A36/ A 36M.

G. Steel Tubing: ASTM A 513.

H. Uncoated, Hot-rolled Steel Sheet: ASTM A 1011/A 1011M structural steel, Grade 30, unless another grade is required by Design loads.

H. Galvanized-Steel Sheet: ASTM A 653.A 653M, G90 (A275) coating, structural steel, Grade 33 (Grade 230), unless another grade is required by design loads.

I. Unistrut, ASTM A576 Grade 1015 Modified, unless another grade is required by Design loads.

2.2 GROUT AND ANCHORING CEMENT

A. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include but are not limited to the following:
   a. B-6 Construction Grout; W. R. Bonsal Co.
   b. Supreme; Cormix Construction Chemicals.
   c. Sure-grip High Performance Grout; Dayton Superior Corp.
   d. Eucn N-S Grout; Euclid Chemical Co.
   e. Five Star Grout; Five Star Products.
   f. Vibropruf #11; Lambert Corp.
   g. Crystex; L & M Construction Chemicals, Inc.
   h. Masterflow 928 and 713; Master Builders Technologies, Inc.
   i. Sealight 588 Grout; W. R. Meadows, Inc.
   j. Sonogrout 14; Sonneborn Building Products--ChemRex, Inc.
   k. Kemset; The Spray-Cure Company.

2.3 FASTENERS

A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

B. Lag Bolts: Square head type, FS FF-B-561.


D. Wood Screws: Flat head carbon steel, FS FF-S-111.


F. Drilled-In Expansion Anchors: Expansion anchors complying with FS FF-S-325, Group VIII (anchors, expansion, non-drilling), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade 5.

G. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

H. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

I. Wire Hangers: Zinc-Coated Carbon-Steel Wire ASTM A641, Class 1 zinc coating.

J. Hanger Rods: Mild Steel, Zinc coated or protected with rust-inhibitive paint.
2.4 PAINT

A. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.

B. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint-20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

D. Zinc Chromate Primer: FS TT-P-645.

2.5 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 100 deg F.

D. Shear and punch metals cleanly and accurately. Remove burrs.

E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Remove sharp or rough areas on exposed traffic surfaces.

G. Weld corners and seams continuously to comply with AWS recommendations and the following:

H. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

1. Obtain fusion without undercut or overlap.
2. Remove welding flux immediately.
3. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent. At pipe railings and handrails grind and sand welds smooth to eliminate surface distortions such as weld puddles, slag, and pits.

I. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not
indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

J. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

K. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

L. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

M. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.6 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

   a. Except as otherwise indicated, provide anchorages as required by manufacturer.

2.8 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

C. Steel and Iron Finishes:

D. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

   1. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning:

E. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

   1. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.
PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. 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 the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

D. Field Welding: Comply with AWS Code for procedures of manual welding, appearance and quality of welds made, methods used in correcting welding work, and 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 that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.3 ADJUSTING AND CLEANING

A. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 Section "Painting" of these specifications.

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 055000
PAGE 1

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Framing with dimension lumber.
   2. Wood blocking and nailers.
   4. Plywood at shear wall

B. Related Requirements:
   1. Division 06 Section "Sheathing."

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NLGA: National Lumber Grades Authority.
   2. SPIB: The Southern Pine Inspection Bureau.
   3. WWPA: Western Wood Products Association.

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 copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
   3. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
   4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

B. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
   1. Mixed southern pine, No. 3 grade; SPIB.
   2. Eastern softwoods, No. 3 Common grade; NeLMA.
   3. Northern species, No. 3 Common grade; NLGA.
   4. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.

2.4 PLYWOOD

A. DOC PS 1, Exposure 1, C-D Plugged,

2.5 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. Furring.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.

C. For utility shelving, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
   1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
   2. Mixed southern pine; No. 1 grade; SPIB.
   3. Hem-fir or hem-fir (north); Select Merchantable or No. 1 Common grade; NLGA, WCLIB, or WWPA.
   4. Spruce-pine-fir (south) or spruce-pine-fir; Select Merchantable or No. 1 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where 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.


D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

2.7 METAL FRAMING ANCHORS

A. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

   1. Use for interior locations unless otherwise indicated.

C. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.

D. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.

E. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

2.8 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
B. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Do not splice structural members between supports unless otherwise indicated.

E. 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.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated.

G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.

J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
   1. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
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. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.3 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs. Fasten plates to supporting construction unless otherwise indicated.
   1. For exterior walls, provide wood studs spaced 16 inches o.c. unless otherwise indicated.
   2. For interior partitions and walls, provide 16 inches o.c. unless otherwise indicated.
   3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

D. Provide bracing in walls, at locations indicated.

END OF SECTION 061000
SECTION 061600 - SHEATHING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Wall sheathing.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
      1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.

1.4 INFORMATIONAL SUBMITTALS
   A. Evaluation Reports: For following products, from ICC-ES:
      1. Preservative-treated plywood.

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS
   A. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.
   B. Oriented Strand Board: DOC PS 2.
   C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
   D. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD
   A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b for exterior construction not in contact with the ground.
      1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
   B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing. Utilize treated plywood for all exterior wall sheathing

2.3 WALL SHEATHING
   1. Span Rating: Not less than 24/0.
   2. Nominal Thickness: Not less than 1/2 inch.
B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.
   1. Span Rating: Not less than 16/0.
   2. Nominal Thickness: Not less than 1/2 inch.

2.4 FASTENERS
A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
B. Nails, Brads, and Staples: ASTM F 1667.
D. Wood Screws: ASME B18.6.1.

2.5 SHEATHING JOINT-AND- PENETRATION TREATMENT MATERIALS
A. Sheathing tape as manufactured by SIGA Wiglув 60 Tape, approved equal.
   1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with OSB and plywood sheathing and with a history of successful in-service use.
   2. Tape shall be compatible with emulsion water proofing.

PART 3 - EXECUTION
3.1 INSTALLATION, GENERAL
A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WALL SHEATHING PLACEMENT

A. Unless otherwise noted on the drawings, install the wall sheathing as specified below:
   1. Exterior Plywood sheathing shall be applied at the bottom 24 inches (minimum) of the exterior walls.
   2. Exterior Plywood sheathing shall be applied full height at all exterior and interior corners of the exterior walls with a minimum width of 48 inches.
   3. OSB sheathing shall be applied in all other areas of exterior walls.

END OF SECTION 061600
SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section applies to the following:

1.3 DEFINITIONS
   A. Thermal Resistivity (r-value): Where thermal resistivity properties of insulation materials are designated by "r-values" they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause on BTU to flow through one square foot per hour at mean temperatures indicated.
   B. Thermal Resistance (R-value) is the reciprocal of thermal conductance (C-value) which is the rate of heat flow through a material of the thickness indicated. Thermal resistance (R-value) is expressed by the temperature difference in degrees F (Kelvins) between the two exposed faces required to cause 1 Btu to flow through 1 sq. ft. (1 watt to flow through 1 sq. m) per hour at the mean temperature indicated.

1.4 ACTION SUBMITTALS
   A. Product Data:
      1. For each type of insulation product indicated
      2. Anchor product data for each insulation type and substrate.

1.5 QUALITY ASSURANCE
   A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 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.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION
   A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
5. Owens Corning.

B. Kraft-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

C. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
   1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.2 GLASS FIBER INSULATION FASTENERS
A. Anchor insulation to substrates with anchors and/or adhesives as recommended by the insulation manufacturer for that substrate.

2.3 INSULATION ACCESSORIES
A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with built-up roofing.
B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate and acceptable to roofing manufacturer.
C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
D. Wood Nailer Strips: Comply with requirements in Section 061000 "Rough Carpentry."
E. Substrate Joint Tape: 6- or 8-inch-wide, coated, glass fiber.

PART 3 - EXECUTION
3.1 PREPARATION
A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL
A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.
3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

C. Mineral Wool Blanket Insulation: Install in cavities formed by framing members where required for acoustical treatment as indicated on drawings according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

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 072100
SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Formed roof-drainage sheet metal fabrications.
   2. Gutters and downspouts
   3. Gutter dams

B. Related Requirements:
   1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.

C. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

D. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

E. Contractor to ensure that any associated work, under this section, will not void the current roof warranty.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Surface: Smooth, flat.
2. Exposed Coil-Coated Finish:
   a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 ROOF GUTTERS AND DOWNSPOUTS

A. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Manufactured Hanger Style:
   2. Fabricate downspouts from the following material:
      a. Prepainted, Metallic-Coated Steel: 0.0217 inch thick.

B. Integral Gutter: Fabricate sloping gutter complete with sleeve for downspout. Furnish with tabs and brackets for mounting to substrate indicated.
   1. Gutter Style: Custom.
   2. Fabricate gutter from the following material:
      a. Metallic-Coated Steel: 0.0217 inch thick.
C. Dams:

2.4 UNDERLAYMENT MATERIALS
A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

2.5 MISCELLANEOUS MATERIALS
A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   2. Fasteners for Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
E. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.6 FABRICATION, GENERAL
A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

F. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.

5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws. Do not penetrate wood decking that it to remain exposed.

D. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

E. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.
3.5 **ERECTION TOLERANCES**

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

3.6 **CLEANING AND PROTECTION**

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 076200**
SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Silicone joint sealants.
   2. Urethane joint sealants.
   3. Latex joint sealants.

1.3 SUBMITTALS
A. Product Data: For each joint-sealant product indicated.

1.4 QUALITY ASSURANCE
A. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
B. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
   2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

1.5 PROJECT CONDITIONS
A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL
A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.2 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
   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. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
      b. Tremco Incorporated; Vulkem 921 or Dymonic FC.

2.3 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
   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. Dow Corning Corporation; 790.
      b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
      c. May National Associates, Inc.; Bondaflex Sil 728 NS.
      d. Pecora Corporation; 301 NS.
      e. Sika Corporation, Construction Products Division; SikaSil-C990.
      f. Tremco Incorporated; Spectrum 1.

B. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
   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. Pecora Corporation; 898.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. BASF Building Systems; Sonolac.
      d. Pecora Corporation; AC-20+.
      e. Schnee-Morehead, Inc.; SM 8200.
      f. Tremco Incorporated; Tremflex 834.
2.5 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), 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 capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, 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.
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.
   c. Porcelain enamel.
   d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 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.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.

5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
   a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Inspect tested joints and report on the following:
   1. Whether sealants filled joint cavities and are free of voids.
   2. Whether sealant dimensions and configurations comply with specified requirements.
   3. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

3.5 CLEANING

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

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Sealant Color, general.
   1. Generally use sealant colors matching color of material that joint is located in.
   2. Where wall adjoin other materials or trim, use sealants that match the wall color.
   3. Where a joint occurs between two materials of differing colors contact Architect for selection.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal non traffic surfaces:
   1. Joint Locations:
      a. Control and expansion joints in unit masonry.
      b. Joints between different materials listed above.
      c. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
      d. Urethane Joint Sealant: Single component, nonsag, Class 100/50.
   2. 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.
   1. Joint Locations:
      a. Control and expansion joints in unit masonry.
      b. Joints between different materials listed above.
   2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50.
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 Sealant Location:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Tile control and expansion joints where indicated.
      c. Other joints as indicated.
   2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Perimeter joints between interior wall surfaces and frames of interior doors, casework, windows, trim, and elevator entrances.
      b. Other joints as indicated.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200
SECTION 081100 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of standard steel doors and frames is indicated and scheduled on drawings.
   1. This work includes:
      a. Exterior steel doors and frames.
      b. Exterior steel doors with half light and frames.
   2. Drawing and Scheduling Designations: This section applies to doors and frames referenced on the drawings and schedules using the terms "Hollow Metal Door", "Hollow Metal Frame", "Steel Door" and "Steel Frame".

B. Related Sections:
   1. Division 08 "Finish Hardware" for hardware.

1.3 QUALITY ASSURANCE

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements.

B. Shop Drawings: Submit for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

C. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory-finished doors.

B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering steel doors and frames which may be incorporated in the work include; but are not limited to, the following:
   1. Ceco Corp.
   2. Curries Mfg., Inc.
   3. Deansteel, Mfg., Inc.
   4. Tex-Steel Corp.

2.2 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.

B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G60 zinc coating, mill phosphatized.

D. Supports and Anchors: Fabricate of not less than 18-gage galvanized sheet steel.

E. Inserts, Bolts, and Fasteners: Manufacturer’s standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

F. Shop Applied Paint:
   1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.3 FABRICATION, GENERAL

A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer’s plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site. Comply with SDI-100 requirements as follows:
   1. Exterior Doors: SDI-100, Type III, extra heavy-duty, Style 2, minimum 16-gage galvanized steel faces; where indicated, Type FG per SDI-106 and to be insulated.

B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel.

C. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at fabricator’s option).

D. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.

E. Finish Hardware Preparation: Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.
F. Frame Construction: Fabricate frames to shape shown.
   1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
   2. Provide welded frames with temporary spreader bars.
   3. Exterior Door Frames: 14 gage galvanized steel, with prime coat for field painting.

G. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.

H. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.

I. Shop Painting:
   1. Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
   2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
   3. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive field-applied finish paint.

2.4 STANDARD STEEL DOORS

A. Provide metal doors of types and styles indicated on drawings or schedules. All metal doors to have insulated interior construction.

B. Coordinate steel doors with adjacent work as required to assure proper installation.

2.5 STANDARD STEEL FRAMES

A. Provide metal frames for doors, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16-gage cold-rolled furniture steel.
   1. Fabricate frames with mitered and welded corners.
   2. Form exterior frames of hot-dip galvanized steel.

B. Door Silencers: Except on weather-stripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.

C. Plaster Guards: Provide 26-gage steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

D. Where indicated provide Sidelite and/or Transom Frames: Fabricated from same thickness material as adjacent door frame. Fasten members at crossings and to jambs by butt welding.

2.6 GLASS PRODUCTS

A. Safety Glass: Clear; heat strengthened.
   1. Laminated with 0.015 inch thick plastic interlayer; comply with ASTM C1172, ¼” inch thick.
PART 3 - EXECUTION

3.1 DOOR INSTALLATION

A. General: Install standard sheet doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.
   1. Except for frames located at in-place concrete or masonry and at drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
   2. In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels.
   3. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
   4. Install fire-rated frames in accordance with NFPA Std. No. 80.
   5. In metal stud partitions, install 4 wall anchors in hinge jamb, and 3 wall anchors in strike jamb; two at top hinge level of hinge jamb, and one each at hinge and strike levels. In steel stud partitions, attach wall anchors to studs with tapping screws.

C. Door Installation:
   1. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.
   2. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

3.2 ADJUST AND CLEAN

A. Prime Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Clean surfaces promptly after installation of doors. Exercise care to avoid damage to the finish. Remove excess glazing and sealant compounds, dirt, and other substances.

C. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION 081100
SECTION 081400 – WOOD DOORS

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section specifies stile and rail wood doors of the following types:
   1. Interior wood doors.
B. Related Work: The following items are not included in this Section and are specified under the designated Sections.
   1. Division 06 Section “Rough Carpentry” for rough opening and blocking.
   2. Division 08 Section “Steel Doors and Frames” for interior metal door frames
   3. Division 08 Section “Finish Hardware” for operating and locking hardware.

1.3 SUBMITTALS
A. Product Data: Submit manufacturer's product data for each type of wood door including elevations and details of construction.
B. Shop Drawings: Submit shop drawings of wood doors including door type, door design number, door size, fire rating if applicable, hardware types and locations, hardware blocking requirements and location, panel layout, molding and sticking profile, and finishing.
C. Verification Samples: Submit two corner samples, minimum 6 inches by 6 inches representing actual products and materials specified indicating visual characteristics and finish. Include range samples if variation of appearance is anticipated. Submit manufacturers full range of standard finish colors.
D. Warranty: Submit manufacturer’s standard warranty.

1.4 QUALITY ASSURANCE
A. Manufacturer’s Qualifications: Company specializing in manufacturing doors with a minimum of five years documented experience.
B. Single Source Requirements: To the greatest extent practical, wood doors shall be supplied from a single manufacturer.
C. Sustainable Construction: Paneled door construction shall limit use of formaldehyde products during fabrication.
D. Project Conditions: Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer’s recommended limits.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store and handle materials and products in strict compliance with manufacturer’s instructions, recommendations and industry standards.
B. Store materials in manufacturer's original labeled packaging until ready for installation and in accordance with manufacturer's instructions. Protect from damage.

1.6 WARRANTY
A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty that each panel door bearing the manufacturer's brand and identification mark complies with Industry Standard WDMA I.S.6A and all revisions in effect as of the date of manufacture, and that each such door, at the time of the shipment, is of good material and workmanship and free from defects that would render such door unserviceable or unfit for the ordinary, recommended use.

PART 2 - PRODUCTS
2.1 MANUFACTURER
A. Basis of Design for interior doors: JELD-WEN, Inc.; 440 South Church Street, Suite 400, Charlotte, NC 28202; Toll Free Tel: 800-535-3936; Tel: 541-850-2606; Fax: 541-851-4333; Email: architectural_inquiries@jeld-wen.com; Web: http://www.jeld-wen.com. Or approved equal.

2.2 INTERIOR WOOD DOORS
A. Solid Core “Flush” Finish: as manufactured by Jeld-Wen, Inc.
1. Construction: Solid mineral core
   a. Thickness: 1-3/4” or approved equal
   b. Species: Red Oak
   c. Stain Finish: Nutmeg

B. Other Acceptable Manufacturers: Solid Core Doors with Wood Veneer Faces:
   a. Algoma Hardwoods, Inc.
   b. Buell Door Company.
   c. Cal-Wood Door Div., Timberland Industries, Inc.
   d. Eggers Industries, Architectural Door Division.
   e. Glen-Mar Door Mfg. Co.
   f. Mohawk Flush Doors, Inc.
   g. Marshfield Doors.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. Hardware: For installation, see Door Hardware specification
B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081400
SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Service doors.

1.3 ACTION SUBMITTALS
A. Product Data: For each type and size of overhead coiling door and accessory.
   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
B. Samples for Initial Selection: Manufacturer’s finish charts showing full range of colors and textures available for units with factory-applied finishes.

1.4 CLOSEOUT SUBMITTALS
A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL
A. Basis of Design: Coil Away, Model 600, by Overhead Door Corporation.

2.2 PERFORMANCE REQUIREMENTS
A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
   1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.

2.3 DOOR ASSEMBLY
A. Curtain: Interlocking roll-formed galvanized steel slats, flat crown profile type CAW, 26 gauge for widths up to 12 feet 4 inches (3.75 m), 24 gauge for widths up to 16 feet (4.88 m). End of each slat shall be locked from lateral movement by a staking lock system. (Galvanized alternate malleable end locks.)
B. Finish:
   1. Curtain slats and hood shall be galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
   a. Polyester Top Coat.
      1) White polyester.
      2) Brown polyester.
b. Powder Coat:
   1) PowderGuard Premium: Powder coat color as selected by the Architect.

c. Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.

C. Weatherseals: Vinyl bottom seal.

D. Bottom Bar: Extruded aluminum.

E. Guides: Roll-formed galvanized steel shapes attached to continuous galvanized steel wall angle.

F. Finish: PowderGuard Premium powder coat, color as selected by Architect.

G. Brackets: Galvanized steel to support counterbalance and curtain.

H. Finish: PowderGuard Premium powder coat, color as selected by Architect.

I. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel and supporting the curtain with deflection limited to 0.03 inch per foot of span. Spring tension shall be adjustable.

J. Hood: 24-gauge galvanized steel with intermediate supports as required.

K. Manual Operation:
   1. Manual push up for doors up to 100 SF.
   2. Chain hoist for doors over 100 SF.

L. Locking:
   1. Two interior bottom bar slide bolts for manually operated doors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

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

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
B. Lubricate bearings and sliding parts as recommended by manufacturer.

END OF SECTION 083323
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: Composite-framed windows of the following types: single-hung with screens at exterior side.

1.3 REFERENCES
A. General: Standards listed by reference form a part of this specification section. Standards listed are identified by issuing authority, abbreviation, designation number, title or other designation. Standards subsequently referenced in this Section are referred to by issuing authority abbreviation and standard designation.
B. American Architectural Manufacturers Association (AAMA):
   1. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
C. Andersen Unit Installation Guide.
D. ASTM International (ASTM):
E. Insulating Glass Certification Council (IGCC):
   1. Insulating Glass Unit Certification.
F. International Standards Organization (ISO):
   1. ISO 14021 - Environmental Labels and Declarations -- Self-Declared Environmental Claims (Type II Environmental Labeling).
G. National Fenestration Rating Council (NFRC):
   1. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

H. U.S. Environmental Protection Agency (EPA):
   1. ENERGY STAR.

I. Window and Door Manufacturers Association (WDMA):
   1. WDMA Hallmark Certification Program for Manufacturers.

1.4 SUBMITTALS
A. Product Data: For each type of product required.
B. Shop Drawings: Showing methods of installation, plans, sections, elevations and details of walls, specified loads, flashings, vents, sealants, and interfaces with all materials not supplied by the window manufacturer, and identification of proposed component parts and finishes.
C. Samples: Selection and verification samples for finishes, colors and textures. Submit two complete sample sets of each type of material required.
D. Certificates: Signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
E. Test and Evaluation Reports: Showing compliance with specified performance characteristics and physical properties.
F. Manufacturer’s Instructions: Manufacturer installation, storage, and other instructions.
G. Qualification Statements: For manufacturer and installer.

1.5 QUALITY ASSURANCE
A. Manufacturer Qualifications:
   1. Member in good standing of The Insulating Glass Certification Council (IGCC).
   2. Hallmark Certified Manufacturer and member in good standing of the Window and Door Manufacturers Association (WDMA).
B. Installer Qualifications:
   1. Minimum five years’ experience in the commercial installation of products required for the Project.
   2. Experience on at least five projects of similar size, type and complexity as the Project.
   3. An entity utilizing workers competent in techniques required by manufacturer for product types and applications indicated.

1.6 DELIVERY, STORAGE AND HANDLING
A. Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.
B. Deliver materials to Project in manufacturer’s original unopened, undamaged containers with identification labels intact.
C. Storage and Protection: Store materials and accessories protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by manufacturer off ground, under cover and not exposed to weather and construction activities.
1.7 WARRANTY

A. Special Warranty: Manufacturer's transferrable, non-prorated limited warranty.
   1. Warranty Period, Glass: 20 years.
   2. Warranty Period, Non-Glass Parts: 10 years.
   3. Warranty Period, Color Fade: 5 years.

B. Special Warranty: Installer's standard form in which installer agrees to repair or replace composite windows that fail due to poor workmanship or faulty installation within the specified warranty period.
   1. Warranty Period: two years from date of Substantial Completion.

PART 2 - PRODUCT

2.1 COMPOSITE WINDOWS

A. General: Provide composite windows complying with the performance requirements indicated and tested according to NAFS.

B. Basis-of-Design Product: Subject to compliance with requirements provide Ply-Gem (Home Depot).

C. Substitution Limitations: All other manufacturers: Submit substitution request in accordance with Substitution Procedures.

2.2 MATERIALS

A. Material Composition: Extruded composite profile consisting of 40 percent reclaimed pre-consumer wood fiber and 60 percent thermoplastic polymer, by weight.

B. Manufacturer Designation: Fibrex material.

C. Interior Color: To be selected by Architect from manufacturer's full range of color options.

D. Exterior Color: To be selected by Architect from manufacturer's full range of color options.

E. Exterior Color Retention: Resist fading with a change of no more than 5 Delta E units over 10 years in compliance with color retention provisions of AAMA 615 and ASTM D2244.

2.3 WINDOW

A. Window Type: As indicated on drawings.

B. Performance Requirements: Comply with NAFS.
   1. Single-hung, Performance Class and Grade: LC-PG30

C. Environmental Qualifications:
   1. ENERGY STAR performance.
   2. Indoor air quality performance.

D. Weatherstrip Type and Material: Three fins and pile, polypropylene or Flexible tubular and leaf, vinyl.

E. Attachment Flange: 1-3/8 inches flange setback or 1 inch flange setback with stucco key as required for specific substrate application.

F. Hardware:
   1. Operator Gear Type and Material: Rotary, die cast zinc.
2. Hinge Type and Material: Hinged, 300 series stainless steel with heavy gauge arms.
3. Operator Handle Type and Material: Folding, polycarbonate with integral color.
5. Hardware Type and Material: Self-latching, polycarbonate with integral color.

G. Insect Screens:
1. Frame Material: Aluminum.
2. Frame Color: Match window frame.
3. Insect Screen Material: Fiberglass cloth secured with metal spline.

2.4 GLAZING
A. Glass Units: Provide insulating glass units certified through Insulating Glass Certification Council as conforming to the requirements of IGCC and ASTM E2190.
1. Manufacturer Designation: Ply-Gem tinted, double pane, tempered glass.
2. Seal and Spacer Type: Dual sealed insulating glass units with polyisobutylene primary seal, silicone secondary seal and metal spacers with bent or soldered corners.
3. Glass Type: Flat glass, ASTM C1036 or heat strengthened tempered glass, ASTM C1048 as designated on drawings or as required by Code.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
D. Always retain paragraph below.
E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. General: Comply with manufacturer’s product recommendations, including but not limited to the Andersen Unit Installation Guide, and installation information in product literature and on product packaging. Comply with Drawings and Shop Drawings for installing windows, hardware, accessories, and other components.
B. Install windows plumb, level and square. Anchor windows securely to structure in correct orientation to flashing and adjacent construction as indicated. Comply with installation instructions for proper flashing integration of window into wall system. Install windows so as to drain water penetration to the exterior.
C. Adjust sashes, insect screens, ventilators, hardware and accessories as applicable for correct fit. Adjust weatherstrip for smooth operation and weather-tight closure.
3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: If requested by Owner, provide manufacturer’s field service consisting of product use recommendations and periodic site visits for observation of product installation in accordance with manufacturer’s recommendations.
   1. Site Visits: One per building.

B. Field Testing: Provide field testing of installed units.
   1. Test units in compliance with AAMA 502.
   2. Use test equipment calibrated according to ASTM E1105.

3.4 CLEANING

A. Remove protective films and non-permanent labels prior to 90 days after installation.

B. Remove excess sealant, soiling, dirt and other substances. Clean window frame and glass surfaces. Avoid damaging coatings and finishes.

C. Touch-up, repair or replace glass or other window components broken, scratched or damaged during construction prior to Substantial Completion.

D. Remove and lawfully dispose of construction debris from Project site.

3.5 PROTECTION

A. Protect installed windows and finish surfaces from damage during construction until completion of Project and acceptance by Owner.

END OF SECTION 085400
SECTION 087100 - FINISH HARDWARE

1.1 SUMMARY

A. Section includes:
   1. Mechanical door hardware for the following:
      a. Swinging wood and steel doors.
      b. Coiling door hardware by manufacturer.
   2. Cylinders for door hardware specified in other Sections.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
B. Samples: As requested.
C. Schedules shall be kept current with all changes to the project. If changes occur, project hardware schedules shall be maintained to reflect the changes as they are approved. Omitted items shall be deleted from openings, added and replaced items shall be included. Installation submittals shall be kept current as changes occur. Upon request, a complete updated hardware schedule shall be provided to the contractor. Supplemental submittals that include only the changed openings will not be acceptable.
D. Prior to final payment, provide a record copy of hardware schedules, including all revisions and updates. All openings shall be listed to reflect final installed configuration only.
E. Other Action Submittals:
   1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
      a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
      b. Content: Include the following information:
         1) Identification number, location, hand, fire rating, size, and material of each door and frame.
         2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
         3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
         4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
   2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.

1.3 QUALITY ASSURANCE

A. Supplier Qualifications: Hardware Supplier: The hardware supplier must be a corporate member in good standing of The Door and Hardware Institute (DHI), employing at least one Architectural Hardware Consultant (AHC) who is currently participating in DHI’s continuing education program (CEP). Retain first paragraph below if applicable.
FINISH HARDWARE

B. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

A. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated. Provide positive latching and self closing, regardless if specified in sets.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
   1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
   2. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
      b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
      c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
   3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
   4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

F. Items of hardware not definitely specified herein but necessary for completion of the work shall be provided. Such items shall be of type and quality suitable to the service required and comparable to the adjacent hardware. Where size and shape of members is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified. Sizes shall be adequate for the service required.

G. Include such nuances as strike type, strike lip length, raised barrel hinges, mounting brackets, blade stop spacers, special templates, fasteners, shims, and coordination between conflicting products. All doors shall be provided with a stop.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

B. Deliver keys and permanent cores to Owner by registered mail or overnight package service.
1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
1. Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
   a. Exit Devices: Three years from date of Substantial Completion.
   b. Manual Closers: Ten years from date of Substantial Completion.
   c. Cylindrical Locksets: Seven years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

2.2 HINGES

1. Hinge Quantity
   a. Provide 3 hinges per door up to and including 7'5" tall doors.
   b. Provide 1 additional hinge for each additional 2'6" of door height.
2. Hinge size:
   a. Provide 4.5" x 4.5" hinges unless otherwise noted.
3. Hinge weight:
   a. Provide standard weight hinges .134" thick on doors up to and including 36" wide doors.
   b. Provide heavy weight hinges .180" thick on doors above 36" wide.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hager Companies.
   b. McKinney Hardware.
   c. Stanley Commercial Hardware.

2.3 MECHANICAL LOCKS AND LATCHES

A. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on aluminum frames and frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
B. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2.4 MANUAL FLUSH BOLTS
A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. Trimco.
      c. Rockwood Manufacturing Company.

2.5 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS
A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. Trimco.
      c. Rockwood Manufacturing Company.

2.6 EXIT DEVICES AND AUXILIARY ITEMS
A. Exit Devices and Auxiliary Items: BHMA A156.3.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Sargent; 80 Series.
      b. Corbin Russwin; ED5000 Series.
      c. Yale; 7000 Series.
      d. No alternate manufacturers will be accepted without architect’s written approval prior to bidding.

2.7 LOCK CYLINDERS
A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Same as lock manufacturer.
   B. All cylinders to have interchangeable cores.
   C. Provide construction cores for use during construction period.

2.8 KEYING
   1. Grand Master Key System.
B. Keys: Nickel silver.
   1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
      a. Notation: "DO NOT DUPLICATE."
   2. Quantity: In addition to one extra key blank for each lock, provide the following:
2.9 OPERATING TRIM
A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. Trimco.
      c. Rockwood Manufacturing Company.

2.10 ACCESSORIES FOR PAIRS OF DOORS
A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.
B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
C. Astragals: BHMA A156.22.

2.11 SURFACE CLOSERS
A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Sargent; 281 Series.
      b. Corbin Russwin; DC6000 Series.
      c. Norton; 7500 Series.
      d. No alternate manufacturers will be accepted without architect’s written approval prior to bidding.

2.12 MECHANICAL STOPS AND HOLDERS
A. Wall- and Floor-Mounted Stops: BHMA A156.16; stainless steel base metal.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. Trimco.
      c. Rockwood Manufacturing Company.

2.13 OVERHEAD STOPS AND HOLDERS
A. Overhead Stops and Holders: BHMA A156.8.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Glynn-Johnson; an Allegion company.
      b. Rixson Hardware.
2.14 DOOR GASKETING
   A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
      1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         a. Hager Companies.
         b. National Guard Products.
         c. Pemko.

2.15 THRESHOLDS
   A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
      1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         a. Hager Companies.
         b. National Guard Products.
         c. Pemko.

2.16 METAL PROTECTIVE TRIM UNITS
   A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
      1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         a. Hager Companies.
         b. IVES Hardware; an Allegion company.
         c. Rockwood Manufacturing Company.

2.17 AUXILIARY DOOR HARDWARE
   A. Auxiliary Hardware: BHMA A156.16.
      1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         a. Hager Companies.
         b. IVES Hardware; an Allegion company.
         c. Rockwood Manufacturing Company.

2.18 FABRICATION
   A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
      1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where
through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.19 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
C. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
   2. Custom Steel Doors and Frames: HMMA 831.
D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
E. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
F. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).
G. Lock Cylinders: Install construction cores to secure building and areas during construction period.
   1. Replace construction cores with permanent cores as indicated in keying schedule.
   2. Furnish permanent cores to Owner for installation.
H. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

I. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
   1. Configuration: Provide one power supply for each door opening with electrified door hardware.

J. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 “Joint Sealants.”

K. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

L. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

M. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

N. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

O. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.2 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

3.3 DOOR HARDWARE SCHEDULE

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END OF SECTION 087100
SECTION 092000 –GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following:
   1. Interior gypsum board.
   2. Specialty trim.
   3. 5/8” gypsum board
   4. 5/8” moisture resistant at bathroom and shower area.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of product.

1.3 PROJECT CONDITIONS
A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
B. Do not install interior products until installation areas are enclosed and conditioned.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD
A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. American Gypsum Co.
      c. Temple.
      d. USG Corporation.
B. Regular Type:
C. Thickness: 5/8-inch.
   1. Long Edges: Tapered.
   2. Provide one of the following products where Type X gypsum wallboard is indicated:
      a. Gold Bond Brand Fire-Shield Wallboard as manufactured by National Gypsum Co.
      b. Toughrock Fireguard Gypsum Wallboard as manufactured by Georgia-Pacific.
      c. Firecode Core Gypsum Wallboard as manufactured by USG.
E. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   1. Thickness: 1/2-inch.
   2. Long Edges: Tapered.
F. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178, at all Restroom walls and Janitor walls adjacent to mop sink for a minimum of 4' from edge of mop sink., and as follows:
   1. Product: Subject to compliance with requirements, provide "Dens-Shield Tile Backer" manufactured by G-P Gypsum Corp.
   2. Core: 5/8 inch, Type X.

2.2 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
   2. Shapes:
      a. Corner bead, straight and curved.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. L-Bead: L-shaped; exposed long flange receives joint compound.
      d. Expansion (control) joint.
      e. Fry Reglet type “Z” trim.

2.3 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Pre-filling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.
   5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:
   1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
   1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

D. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."

E. Textures Finish materials: Latex-based compound.
PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL
A. Comply with ASTM C 840.
B. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
C. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
D. Locate edge and end joints over supports. Do not place tapered edges against cut edges or ends.
E. Form control and expansion joints with space between edges of adjoining gypsum panels.
F. Cover both faces of support framing with gypsum panels in concealed spaces.
1. Fit gypsum panels around ducts, pipes, and conduits.

3.3 APPLYING INTERIOR GYPSUM BOARD
A. Install interior gypsum board in the following locations:
1. Regular Type: Vertical surfaces, unless otherwise indicated.
2. Ceiling Type: Ceiling surfaces.
B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing).
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 INSTALLING TRIM ACCESSORIES
A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
B. Interior Trim: Install in the following locations:
   1. Corner bead: Use at outside corners.
   2. LC-Bead: Use at exposed panel edges.
   3. L-Bead: Use where indicated.

3.5 FINISHING GYPSUM BOARD

   A. Pre-fill open joints, rounded or beveled edges, and damaged surface areas.
   B. Apply joint tape over joints, except those with trim having flanges not intended for tape.
   C. Gypsum Board Finish Levels: Finish panels to levels indicated below:
      1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
      2. Level 2: Panels that are substrate for tile.
      3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

3.6 FINISHING GYPSUM BOARD

   A. Apply finish texture coating in accordance with manufacturer’s instructions and to match approved sample.

3.7 PROTECTION

   A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
   B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
   C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092000
SECTION 092423 - PORTLAND CEMENT STUCCO

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. 3-Coat impact resistant cement plaster stucco system.
   2. Metal lath and furring.
   4. Metal wall expansion joint.

B. Plywood sheathing for installation behind metal lath is specified in Division 6 Section "Sheathing."

C. Sheet metal flashing for installation coping and flashing is specified in Division 7 Section "Sheet Metal flashing and Trim."

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data consisting of manufacturer’s product specifications and installation instructions for each product, including data showing compliance with the requirements.

C. Samples for initial selection purposes in form of manufacturer’s color charts consisting of actual units or sections of units at least 12 inches (300 mm) square showing full range of colors, textures, and patterns available for each type of finish indicated.
   1. Where finish involves normal color and texture variations, include sample sets composed of two or more units showing full range of variations expected.
   2. Include similar samples of material for joints and accessories involving color selection.

D. Samples for verification purposes in units at least 12 inches (300 mm) square of each type of finish indicated, in sets for each color, texture, and pattern specified, showing full range of variations expected in these characteristics.

E. Material Certificates: Submit producer's certificate for each kind of plaster aggregate indicated evidencing that materials comply with requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer: More than 10 years in the cement plaster stucco industry, with more than 1000 completed plaster stucco projects.

B. Applicator: More than 10 years in the cement plaster stucco industry, with more than 1000 completed plaster stucco projects.

C. Regulatory requirements: conform to applicable code requirements for cement plaster stucco.

D. Field-Constructed Mock-Up: Prior to installation of plaster work, fabricate panels for each type of finish and application required to verify selections made under sample
submittals and to demonstrate aesthetic effects of application as well as qualities of materials and erection. Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work.

1. Erect 48 x 48 inches (1200 x 1200 mm) by full thickness mock-up in presence of Architect using materials, including lath and support system, indicated for final work.
2. Demonstrate the proposed range of aesthetic effects including color, texture, and workmanship to be expected in completed work.
3. Obtain Architect's and Owner's acceptance of mock-ups before start of plaster work. Color/texture to be determined by Architect in conjunction with TPWD Representative.
4. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed plaster work.
   a. When directed, demolish and remove mock-ups from Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer.
B. Store materials inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

1.6 PROJECT CONDITIONS

A. Environmental Requirements, General: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after application of plaster.
B. Cold Weather Protection: When ambient outdoor temperatures are below 40 deg F (4 deg C), maintain continuous uniform temperature of not less than 40 deg F (4 deg C) nor more than 80 deg F (27 deg C) for not less than 1 week prior to beginning plaster application, during its application, and until plaster is dry but for not less than one week after application is complete. Distribute heat evenly; prevent concentrated or uneven heat from contacting plaster near heat source.
C. Ventilation: Ventilate building spaces as required to remove water in excess of that required for hydration of plaster. Begin ventilation immediately after plaster is applied and continue until it sets.
D. Protect contiguous work from soiling, spattering, moisture deterioration and other harmful effects that might result from plastering.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Stucco System Basis-of-Design: The design for Stucco System systems is based on Senergy Sentry Stucco Plus System as manufactured by BASF Corporation Wall Systems. Subject to compliance with requirements, provide the named product or a comparable product by one of listed manufacturers:
   1. Parex
   2. MasterWall, Inc.
   3. LaHabra Stucco
2.2 Materials

A. Water Resistive Barrier:
   1. SENERSHIELD-R: Ready-mixed, flexible Air/Water Resistive Barrier.

B. Slip Sheet: 2 layer 30# asphalt-saturated felt complying with ASTM D226 Type I.

C. PERMALATH 1000.

D. Water: clean and potable without foreign matter.

E. STUCCOBASE:
   1. STUCCOBASE PREMIX: Factory-blended stucco mixture of Portland cement, reinforcing fibers, and proprietary ingredients; supplied by BASF Wall Systems for scratch and brown coats.

F. Senergy Skim Coat/EPS insulation adhesive:
   1. X-TRA STOP BASE COAT:100% acrylic adhesive & base coat that is field mixed with Type I and Type II Portland Cement.

G. Expanded Polystyrene Features.
   1. Insulation Board
      a. In compliance with manufacturer’s requirements for Standard System EIFS.
      b. Produces and labeled under a third party quality program as required by applicable building code and produced by a manufacturer approved by Senergy.
      c. Shall conform to ASTM C578, ASTM E2430 Type I.

   2. Reinforcing Mesh
      b. Intermediate Mesh: Weight 12.0 oz/yd reinforcing mesh.

H. Senergy Reinforcing Mesh: Balanced, open wave glass fiber reinforcing mesh twisted multi-end strands treaded for compatibility with Senergy System components.
   1. Flexguard 4: standard weight, 4 oz.
   2. Hi-Impact 20: heavy weight, 20 oz. used only in combination with FLEXGUARD 4.

I. Senergy STUCCOPRIME: 100% acrylic-based primer: color to closely match the selected Senergy FINISH COAT color.

J. SENERLASTIC Finish, 100% acrylic polymer based, elastomeric finish; air cured, compatible with Base Coat, color as selected by manufacturers full range of color and finish texture CLASSIC.

2.3 ACCESSORIES

A. Trim: Casing bead, corner bead, expansion joint and weep screed accessories shall meet the requirements of ASTM C1063. Accessories shall be; vinyl, meeting ASTM D1784; galvanized, meeting ASTM A525 and ASTM A526; or zinc, meeting ASTM B69.
   1. Foundation weep screed: Beveled edge designed to terminate finish system and drain internal moisture.
   2. Casing Bead: Small radius nose style.
   3. Corner bead: Small radius nose style.
B. Polystyrene Insulation (Type V Construction Only):
   1. Expanded (EPS), or Extruded (XPS), having a minimum density of 1 lb/ft.

2.4 PORTLAND CEMENT PLASTER MATERIALS
A. Base Coat Cements: Type as indicated below:
   1. Portland cement, ASTM C 150, Type I or II.
B. Finish Coat Cement: Type as indicated below:
   1. Portland cement, ASTM C 150, Type I, white.
C. Factory-Prepared Finish Coat: Manufacturer’s standard product requiring addition of water only; white unless otherwise indicated.
D. Lime: Special hydrated lime for finishing purposes, ASTM C 206, Type S, or special hydrated lime for masonry purposes, ASTM C 207, Type S.
E. Sand Aggregate for Base Coats: ASTM C 897.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Verify project site conditions.
B. Compliance: comply with manufacturer’s instruction for installation.
C. Examine surfaces to receive system and verify that substrate and adjacent materials are dry, clean, and sound. Verify substrate surface is flat, free of fins or planar irregularities greater that ¼” in ten feet.
D. Flashings.
   1. All flashings are by others and must be installed in accordance with specific manufacturer’s requirements. Where appropriate, end-dams must be provided.

3.2 PREPARATION
A. Protect all surrounding areas and surfaces from damage and staining during applications.
B. Protect finish work at end of each day to prevent water penetration.

3.3 MIXING
A. General: No additives are permitted unless specified in product mixing instructions. Close containers when not in use. Prepare in a container and/or mixer that is clean and free of foreign substances. Do not use a container and/or mixer which has contained or been cleaned with a petroleum-based product. Clean tools and equipment with water immediately after use. Dried material can only be removed mechanically.
B. Air/Water Resistive Barrier: Mix with a clean, rust-free paddle and drill until thoroughly blended. Do not add water.
C. Stucco Base Coat: Use mixer which is clean and free of foreign substances.
   1. Add clean potable water.
D. Skim Coat/EPS insulation adhesive.
1. Mix X-TRA STOP Base Coat with a paddle and drill until thoroughly blended, before adding Portland cement.
2. Mix Portland cement according to manufacturer’s instructions.

E. Finish Coat SENELASTIC.
1. Thoroughly mix the factory-prepared material with clean paddle and drill until thoroughly blended.
2. Additives are not permitted.
3. Close container when not in use.
4. Clean tools and equipment with water immediately after use. Dried material can only be removed mechanically.

3.4 APPLICATION

A. General: Apply the stucco system materials in accordance with manufacturer’s instructions.
B. All sheathing joints and windows/opening must be protected and the air/water resistive barrier applied in accordance with the manufacturer’s guidelines.
C. Substrate shall be dry, clean, and free of releasing agents, paint, or other residue or coatings. Verify substrate is flat, free of fins or planar irregularities greater than ¼" in 10 feet.
D. Unsatisfactory conditions shall be corrected before application.
E. Installed air/water resistive barrier should be completely dry and checked before continuing system application.
F. Coordinate work with other trades to assure proper sequencing, detailing and installation of materials.
G. Slip sheet to be installed per manufacturer’s recommendations.
H. Install lath per manufacturer’s recommended instructions.
I. Apply STUCCOBASE Premix within 60 days of PERMLATH 1000 applications.
J. Apply base coat system application:
   1. First coat “scratch”: 3/8” – ½"
   2. Second coat “brown”: 3/8” – ½"
K. Apply first coat to completely embed lath. Cross rake slightly to provide key for second brown coat. Coat must be uniform in thickness. Ensure the first coat is properly “scratched” and sufficiently rigid to resist cracking prior to application and leveling of the second or “brown” coat.
L. Apply second coat to provide the required total thickness. Trowel into trim to seat trim. The lath shall be fully embedded in the stucco and shall be completely covered. Coat must be uniform in thickness. Rod off to desired thickness, leveled with screeds, to provide a true, flat plane. Follow this by wood floating or darbing the surface.
M. After surface has sufficiently hardened, use sponge or hard rubber float as required to fill voids, holes or imperfections, leaving the surface ready to receive finish.
N. Damp cure for at least 48 hours.
O. Allow Brown coat to cure a minimum of 6 days prior to application for skim coat, EPS insulation board shapes and finish coat application.

3.5 CLEANING
A. Clean work and adjacent surfaces and remove excess material, droppings, and debris.

3.6 PROTECTION

A. Protect finished work.

END OF SECTION 09 24 23
SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of Contract, including Uniform General and Supplementary Conditions and Division-1 Specification sections, apply to this section.

1.2 SUMMARY
A. Description of Work:
   1. Forms of signs required include the following:
      b. Braille signage for ADA compliance.

1.3 QUALITY ASSURANCE
A. Uniformity of Manufacturer: For each sign form and graphic image process indicated furnish products of a single manufacturer.
B. Braille Signage Assurance: At the time of product submittal, provide a written statement by the manufacturer that its product complies with Section 4.30 of the Americans with Disabilities Act Architectural Guidelines and that all Braille has been proofed and is correct.

1.4 SUBMITTALS
A. Shop Drawings: Submit shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale details of sign wording and lettering layout. Show anchorages and accessory items. Furnish location template drawings for items supported or anchored to permanent construction.
   1. Provide message list for each type of sign required, including large-scale details of wording and layout of lettering.
   2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of work in other Sections.
B. Product Data: Submit manufacturer's technical data and installation instructions for each type of sign required.
C. Samples: Submit samples of each sign form and material showing finishes, colors, surface textures and qualities of manufacturer and design of each sign component including graphics.
   1. Submit full-size sample units, if requested by Owner's Representative. Acceptable units may be installed as part of the work.
   2. Braille Signage Samples: Two sample signs with pictogram, tactile characters, and Braille prior to beginning shop fabrication. Owner will perform destructive testing with one sample to determine durability.
PART 2 - PRODUCTS

2.1 SIGNAGE

A. Acceptable Manufacturers: Provide signs manufactured by one of the following:

1. Grainger Specialties LLC
   PO Box 823
   Burlington, IA 52601
   325 725 2003

2. Architectural Signage Products
   5214 Burleson Road, Suite 405-6
   Austin, Texas 78744

3. Austin Architectural Graphics
   516 Navasota
   Austin, Texas 78702

4. Innovative Graphic Systems
   P.O. Box 33239
   Austin, Texas 78764

5. Trinity Sign Graphics
   7802 Doncast
   Austin, Texas 78745

2.2 MATERIALS FOR INTERIOR SIGNS

A. Interior Signs: 8” x 6” in the following colors, no substitutions or equal are acceptable:
   1. #91E73E Black background with white characters, ADA compliant

2.3 BRAILLE SIGNAGE REQUIREMENTS

A. Construction: Pictographs and Braille characters shall be integral part of the sign.

B. Braille Characters: Grade 2, raised 1/32-inch, placed below raised characters.

C. Raised Characters: Letters and numbers shall be raised 1/32-inch, a minimum of 1-inch in height and no higher than 2 inches in height. Letters and numbers are to be formed by sandblasting area around characters, making them an integral part of the sign face.

D. Spacing: Spacing between vertical elements of raised characters and pictograms shall be 1/8-inch minimum. Spacing between raised characters and braille shall be 3/16-inch minimum.

E. Braille Dimensions: Dot diameter - 0.059 inch, inter-dot spacing - 0.090 inch, horizontal separation between cells - 0.241 inch, and vertical separation between cells - 0.395 inch.

F. Finish and Contrast: Eggshell, matte, or on-glare finish. The contrast between background and characters shall be a minimum of 70 to 1. Provide light characters on
dark background or dark characters on light background. Gloss of the materials shall be within 11 to 19 degrees on a 60 degree gloss meter.

PART 3 - EXECUTION

3.1 FABRICATION FOR THE DIMENSIONAL LETTERS

A. General: comply with requirements indicated for materials, thickness, finishes, colors, designs, shapes, size and details of construction.

B. Designs, fabricate, and install sign assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners.

C. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.

D. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

3.2 EXAMINATION FOR THE DIMENSIONAL LETTERS

A. Site Verification of Conditions: Verify installation conditions are acceptable for product installation in accordance with manufacturer’s instructions.

3.3 INSTALLATION

A. General for Interior Signs: Installation of interior signs shall be such that the sign is placed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, signs shall be placed on the nearest adjacent wall. Mounting height shall be 60 inches above the finish floor to the centerline of the sign. Mounting location shall be so that a person may approach with 3 inches of the sign without encountering protruding objects or standing within the swing of the door.

1. Install sign units level, plumb and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Wall Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:

1. Vinyl-Tape Mounting: Use 3M Devon #8416 double-coated foam tape to mount signs to smooth, non-porous surfaces. Provide blank panel of equal size and color behind signs mounted on clear glass.

3.4 CLEANING AND PROTECTION

A. At completion of the installation, clean sign surfaces in accordance with the manufacturer’s instructions. Protect units from damage until acceptance by the Owner.

3.5 SIGN SCHEDULE – LOCATIONS TO BE DETERMINED

A. Restroom sign: 8 inches by 6 inches (ADA Restroom symbol with man & woman silhouette)

END OF SECTION 101400
SECTION 102800 - 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. Restroom accessories.
   2. Mirrors
   3. Under lavatory guards.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.
B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS
A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS
A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE
A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 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.

1.8 WARRANTY
A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.


F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).


2.2 BASIS-OF-DESIGN

A. Subject to compliance with requirements, provide product indicated on Drawings or these specifications with a comparable product by one of the following:
   1. Bobrick Washroom Equipment, Inc.
   2. American Specialties, Inc.
   4. Pre-approved equal.

2.3 ACCESSORIES

A. Refer to drawing sheet A202 for balance of accessories, Toilet Accessories Schedule.

2.4 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Plumberex Specialty Products, Inc.
   2. Truebro by IPS Corporation.

B. Underlavatory Guard:
   1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.

2.5 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.
PART 3 - EXECUTION

3.1 INSTALLATION
A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
B. Grab Bars: Install to withstand a downward load of at least 250 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 recommendations.

END OF SECTION 102800
SECTION 22 00 00 - GENERAL PLUMBING REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Refer to 23 00 00 – General Mechanical Requirements for all General Plumbing Requirements.

END OF SECTION
SECTION 22 05 03 - PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:
   1. Domestic water piping, within 5 feet of building.
   2. Sanitary sewer piping, within 5 feet of building.
   3. Equipment drains and over flows.
   4. Unions and flanges.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   2. ASME B16.3 - Malleable Iron Threaded Fittings.
   3. ASME B16.4 - Gray Iron Threaded Fittings.
   4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   5. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
   7. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
   8. ASME B31.9 - Building Services Piping.
   9. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
   10. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:
15. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SiDR-PR) Based on Controlled Inside Diameter.
33. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
35. ASTM D3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
36. ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe.
37. ASTM D3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.
44. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.
45. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.

C. American Welding Society:
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
   2. AWS D1.1 - Structural Welding Code - Steel.

D. Cast Iron Soil Pipe Institute:

E. National Fire Protection Association:

1.3 SUBMITTALS

A. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

B. Welders’ Certificate: Include welders’ certification of compliance with ASME Section IX or AWS D1.1.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

C. Design pipe hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 DOMESTIC (HOT & COLD) WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, hard drawn.
   2. Joints: ASTM B32, or Alloy Grade Sn95 tin-silver, lead free solder.

B. CPVC Pipe: ASTM D2846/D2846M, Schedule 40, chlorinated polyvinyl chloride (CPVC) material.
   1. Fittings: ASTM F438, CPVC, Schedule 40, socket type.

2.2 SANITARY SEWER AND VENT PIPING

A. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2729, PVC.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC.
2.4 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Copper Piping: Class 150, bronze unions with soldered.
   3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
   4. PVC Piping: PVC.
   5. CPVC Piping: CPVC.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Copper Piping: Class 150, slip-on bronze flanges.
   3. PVC Piping: PVC flanges.
   4. CPVC Piping: CPVC flanges.
   5. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt on inside and outside before assembly.
C. Prepare piping connections to equipment with flanges or unions.
D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
C. Group piping whenever practical at common elevations.
D. Sleeve pipe passing through partitions, walls and floors.
E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not accessible.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Slope piping and arrange systems to drain at low points.

J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

K. Install piping penetrating roofed areas to maintain integrity of roof assembly.

L. Install valves.

M. Install piping specialties.

N. Insulate piping.

O. Install pipe identification.

3.3 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

A. Install domestic water piping system in accordance with ASME B31.9, local codes and authority having jurisdiction.

3.4 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

A. Install sanitary waste and vent piping systems in accordance with ASME B31.9.

B. Install sanitary waste and vent piping systems in accordance with local plumbing code.

C. Install bell and spigot pipe with bell end upstream.

D. Support cast iron drainage piping at every joint.


3.5 FIELD QUALITY CONTROL

A. Test domestic water piping system in accordance with [applicable code] [local authority having jurisdiction]

1. Provide temporary equipment for testing, including pump and gages. Test piping systems before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds
valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

a. Required test periods are 2 hours each.
b. Test each piping system at 150% of operating pressure indicated, but not less than 125 psi test pressure.
c. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

B. Test sanitary waste and vent piping system in accordance with [applicable code] [local authority having jurisdiction].

1. Fill sanitary piping with water for minimum 15 minutes under 10ft water column pressure.
   a. Observe each test section for leakage at end of test period. Test fails if leakage is observed

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods

3.6 CLEANING

A. Clean and disinfect domestic water distribution system prior to final completion per AWWA C651-05.

B. Provide water sample of disinfected water to testing agency of the owners choosing for verification of potable water disinfection.

END OF SECTION
SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ball valves.
   2. Check valves.

1.2 REFERENCES

A. ASTM International:

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 67 - Butterfly Valves.
   2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
   3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
   4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
   5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
   6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

A. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.
PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers:
   1. Crane Valve, North America
   2. Apollo Valve
   3. Hammond Valve
   4. Milwaukee Valve Company
   5. NIBCO, Inc.
   6. Stockham Valves & Fittings
   7. DeZURIK, Unit of SPX Corp.
   8. Flow Control Equipment, Inc. Model
   9. Homestead Valve Model

2.2 BALL VALVES

A. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two piece body, chrome plated bronze ball, full port, teflon seats, blow-out proof stem, threaded ends with union, lever handle.

B. 2 inches and Smaller: 150 psi at 73 degrees F water temperature, maximum service temperature: 140 degrees F ASTM D1785 PVC body and ball, double lever handle, EPDM seals, teflon seats, full port, single union type with socket ends.

C. 2 inches and Smaller: 150 psi at 73 degrees F water temperature, maximum service temperature: 210 degrees F, ASTM D1785 CPVC body and ball, double lever handle, EPDM seals, teflon seats, full port, single union type with socket ends.

2.3 CHECK VALVES

A. Horizontal Swing Check Valves:
   1. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, threaded ends.

B. Spring Loaded Check Valves:
   1. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, threaded ends.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping system is ready for valve installation.
3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4 inch [ball] valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible.

3.3 VALVE APPLICATIONS

A. Install shutoff and valves at locations indicated on Drawings in accordance with this Section.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball valves in domestic water systems for shut-off service.

D. Install ball valves in domestic water systems for throttling service.

END OF SECTION
SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe hangers and supports.
   2. Hanger rods.
   3. Sleeves.
   4. Formed steel channel.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B31.1 - Power Piping.
   2. ASME B31.5 - Refrigeration Piping.
   3. ASME B31.9 - Building Services Piping.

B. ASTM International:

C. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   5. UL - Fire Resistance Directory.
1.3 DEFINITIONS

A. Firestop (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SUBMITTALS

A. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
   2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

B. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
   2. Firestopping: Submit preparation and installation instructions.

C. Manufacturer's Certificate: Certify firestopping products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Surface Burning Characteristics: Maximum 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

B. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum years documented experience and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.
1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
   1. Carpenter & Paterson Inc.
   2. Creative Systems Inc.
   3. Flex-Weld, Inc.
   4. Glope Pipe Hanger Products Inc.
   5. Michigan Hanger Co.

B. Plumbing Piping - DWV:
   1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, MSS SP89.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   4. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
   5. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
   7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   8. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water:
   1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, MSS SP89.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
   7. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   8. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.
2.3 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: Schedule 80 PVC.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Schedule 80 PVC.

C. Sealant: Acrylic.

2.4 FORMED STEEL CHANNEL

A. Manufacturers:
   1. Allied Tube & Conduit Corp.
   4. Unistrut Corp.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

3.2 PREPARATION

A. Obtain permission from Architect/Engineer before using powder-actuated anchors.

B. Do not drill or cut structural members.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.9, ASTM F708, MSS SP58, MSS SP69, MSS SP89.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
G. Support riser piping independently of connected horizontal piping.

H. Provide copper plated hangers and supports for copper piping.

I. Design hangers for pipe movement without disengagement of supported pipe.

J. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation.

3.4 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 2 inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with stuffing insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install stainless steel escutcheons at finished surfaces.

END OF SECTION
SECTION 22 07 00 - PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plumbing piping insulation, jackets and accessories.

1.2 REFERENCES

A. ASTM International:
   3. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
   8. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).

1.3 SUBMITTALS

A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
1.4 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years’ experience approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
   1. CertainTeed.
   2. Knauf.
   4. Owens-Corning.
   5. Substitutions: With engineer approval.
B. Manufacturers for Closed Cell Elastomeric Insulation Products:
   1. Aeroflex.
   2. Armacell, LLC.
   5. Substitutions: With engineer approval.

2.2 PIPE INSULATION

A. GF: ASTM C547, rigid, molded glass fiber pipe insulation
   1. Thermal Conductivity: 0.23 at 75 degrees F.
   2. Operating Temperature Range: 0 to 850 degrees F.
   4. Jacket Temperature Limit: minus 20 to 150 degrees F.
   5. Where multiple layers of insulation are required, only the exterior layer shall be required to have the jacket applied. Multiple layers seams shall be staggered.

B. CG: ASTM C552; Type II rigid cellular glass.
   1. Thermal Conductivity: 0.29 at 75 degrees F.
   2. Operating Temperature: -20 to 900 degrees F.

C. CF: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
   1. Thermal Conductivity: 0.27 at 75 degrees F.
   2. Operating Temperature Range: Range: Minus 70 to 220 degrees F.

2.3 PIPE INSULATION JACKETS

A. ASJ - Vapor Retarder Jacket:
   1. ASTM C1136, white Kraft paper with glass fiber yarn, bonded to aluminized film.
   2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

B. PVC – Polyvinyl Chloride Jacket:
   1. ASTM E84, high impact, UV-resistant, white color.
   3. Connections: per manufacturer recommendations.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

F. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

G. Adhesives: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping has been tested before applying insulation materials.

B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.

C. Piping Systems Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. Hot Piping Systems less than 140 degrees F:
   1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
   3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.

E. Inserts and Shields:
   1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
   a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
   b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

F. Insulation Terminating Points:
   1. Condensate Piping: Insulate entire piping system and components to prevent condensation.

G. Closed Cell Elastomeric Insulation:
   1. Push insulation on to piping.
   2. Miter joints at elbows.
   3. Seal seams and butt joints with manufacturer’s recommended adhesive.
   4. When application requires multiple layers, apply with joints staggered.
   5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

H. High Temperature Pipe Insulation:
   1. Install in multiple layers to meet thickness scheduled.
   2. Attach each layer with bands. Secure first layer with bands before installing next layer.
   3. Stagger joints between layers.
   4. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

END OF SECTION
SECTION 22 33 00 - ELECTRIC DOMESTIC WATER HEATERS – EXISTING WATER HEATER INSTALLATION ONLY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Residential electric water heaters.

1.2 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience or approved by manufacturer.

PART 2 PRODUCTS – EXISTING WATER HEATER, INSTALLATION ONLY

PART 3 EXECUTION

3.1 INSTALLATION

A. Maintain manufacturer's recommended clearances around and over water heaters.

B. Install the following piping accessories
   1. On supply:
      a. Thermometer well and thermometer.
      b. Strainer.
      c. Pressure gage.
      d. Shutoff valve.
   2. On return:
      a. Thermometer well and thermometer.
      b. Pressure gage.
      c. Shutoff valve.

C. Install discharge piping from relief valves and drain valves to nearest floor drain.

D. Install water heater trim and accessories furnished loose for field mounting.

E. Install electrical devices furnished loose for field mounting.

F. Install control wiring between water heater control panel and field mounted control devices.

END OF SECTION
SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Water closets.
   2. Lavatories.
   3. Sinks.
   4. Service sinks.
   5. Showers.
   7. Emergency Eye and Face Wash.
   8. Emergency Combination Shower with Eye and Face Wash.

1.2 REFERENCES

A. American National Standards Institute:
   2. ANSI Z124.1 - Plastic Bathtub Units.
   3. ANSI Z124.2 - Plastic Shower Units.

B. Air-Conditioning and Refrigeration Institute:
   1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

C. American Society of Mechanical Engineers:
   1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
   2. ASME A112.18.1 - Plumbing Fixture Fittings.
   4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
   5. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
   6. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
   7. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 SUBMITTALS

A. Product Data: Submit catalog illustrations of fixtures, sizes, utility sizes, trim, and finishes.

B. Manufacturer's Installation Instructions: Submit installation methods and procedures.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
1.4 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.5 QUALITY ASSURANCE
A. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., as suitable for purpose specified and indicated.
B. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

1.6 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience, and with service facilities within [100] miles of Project.
B. Installer: Company specializing in performing Work of this section with minimum three years’ experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Accept fixtures on site in factory packaging. Inspect for damage.
B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 EXTRA MATERIALS
A. Furnish two sets of faucet washers, lavatory supply fittings, shower heads, and toilet seats.

PART 2 PRODUCTS

2.1 TANK TYPE WATER CLOSETS
A. Bowl: ASME A112.19.2M; refer to Plumbing Fixture Schedule.
B. Seat: refer to Plumbing Fixture Schedule.

2.2 LAVATORIES
A. Vitreous China Wall Hung Basin: ASME A112.19.2M; refer to Plumbing Fixture Schedule.
B. Supply Fitting: ASME A112.18.1; refer to Plumbing Fixture Schedule.
C. Waste Fittings: ASME A112.18.2 or ASTM F 409.

D. For public hand washing facilities, provide tempered water through regulating device conforming to ASSE 1070.

E. Accessories:
   1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
   2. Offset waste with perforated open strainer.
   3. Wheel handle stops.
   4. Rigid supplies.
   5. Trap and waste insulated and offset to meet ADA compliance.

F. Wall Mounted Carrier: ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.3 SHOWERS

A. Trim: ASME A112.18.1; refer to Plumbing Fixture Schedule.

B. Provide backflow protection in accordance with ASME A112.18.1 or by device complying with ASME 112.18.3.

2.4 SERVICE SINKS

A. Bowl: refer to Plumbing Fixture Schedule.

B. Trim: ASME A112.18.1; refer to Plumbing Fixture Schedule.

C. Accessories:
   1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
   2. Hose clamp hanger.
   3. Mop hanger.

2.5 EMERGENCY EYE AND FACE WASH - ALTERNATE

A. ANSI Z358.1; refer to Plumbing Fixture Schedule.

2.6 LAVATORY INSULATION KIT

A. Product Description: Where Lavatories are noted to be insulated for ADA compliance, furnish the following: Safety Covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.
PART 3 EXECUTION

3.1 EXAMINATION

A. Verify walls and floor finishes are prepared and ready for installation of fixtures.
B. Verify electric power is available and of correct characteristics.
C. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.
B. Provide chrome plated rigid supplies to fixtures with wheel handle stops, reducers, and escutcheons.
C. Install components level and plumb.
D. Install and secure fixtures in place with wall carriers and bolts.
E. Seal fixtures to wall and floor surfaces with sealant, color to match fixture.
F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.
G. For ADA accessible water closets, install flush valve with handle to wide side of stall.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.
3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit use of fixtures before final acceptance.

END OF SECTION
SECTION 23 00 00 - GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes requirements that expand the requirements specified in Uniform General Conditions and applies to all Division 23 – Heating, Ventilating, and Air-Conditioning (HVAC) Specification Sections. It is the intent of the contract documents to provide an installation complete in every respect. Work shall be executed in a workmanlike manner and shall include all labor, materials, and supervision essential to provide complete functioning systems as described in the contract documents. In the event that additional details or special construction is required for work indicated, it shall be the responsibility of the contractor to provide same as well as to provide material and equipment usually furnished with such systems or required to complete the installation at no expense to the owner.

B. If any duplication between this section and the Uniform General Conditions, including Supplementary General Conditions plus the General Requirements of Division 1, Section 01000 arise, the UGC and Division 1 specifications shall take precedent.

C. Conflict Resolution: Where conflicts may exist between the minimum requirements of various laws, codes, authorities, and/or within the Contract Documents, the higher quality, greater quantity, more restrictive and/or more expensive requirement shall be the basis of Contractor pricing and the Contractor shall notify the Engineer and Texas Parks & Wildlife Department staff for the resolution of the issue during the bidding period.

D. Should any errors, omissions, conflicts, or ambiguities exist in the drawings, the contractor shall bring these to the attention of the engineer during the bidding period for adjustment in writing before signing the contract or proceeding with the work. Otherwise, he shall at his own expense, supply the proper materials and labor to make good any damage or defect caused by such unintentional error.

E. Contractor is responsible for checking all contract documents, field conditions and dimensions for accuracy, and confirming that the work is buildable as shown and meets all applicable codes before proceeding with construction. If there are any questions regarding these or other coordination issues, the contractor is responsible for obtaining a clarification from the Engineer during the bidding period.

F. Contractor shall direct all questions to the Owner’s Designated Representative (ODR). The contractor shall verify all working conditions such as starting time, noise and vibration limitations, confined space, etc. Through the project coordinator and approval shall be received to start work.

G. Field Conditions: The contractor is responsible for visiting the jobsite and verifying the scope of work required including all existing conditions, locations, dimensions, and quantities as shown and noted on the drawings and the extent and effect of existing systems. The contractor shall be responsible for field verification of existing conditions,
and shall perform field measurements prior to fabrication and/or purchase of any material and shall contact the project manager should existing conditions be different from the design drawings for this project. Conflicts arising due to lack of coordination shall be the responsibility and at the expense of the contractor.

H. Related Sections:
   1. Drawings, Contract, Uniform General Conditions including Supplementary General Conditions, and Division 01 – General Requirements Specification Sections apply to this and all other Division 22 Specification Sections.

I. Deviations to the intended design or the scope of the work must be approved by the project engineer prior to commencing work. Failure to do so may result in the work to be removed at no cost to the owner.

J. All work shall be performed in accordance with all applicable local codes, standards, and amendments and/or other authorities that may have jurisdiction pertaining to the work. In addition, all work shall conform to the standards and practices of the owner.

K. Coordination:
   1. The contractor shall be responsible for ensuring full coordination with other trades and contractors to accomplish the work as shown and noted in these contract documents. The contractor shall compare the drawings of other trades and report any discrepancies to the owner's representative.
   2. The contractor shall not fabricate or install items as shown on the drawings if there are discrepancies or conflicts between the existing conditions and the information shown on the drawings until such discrepancies have been resolved. Prior to fabrication or installation, the contractor shall immediately call such discrepancies or conflicts to the attention of the project coordinator.
   3. Ductwork, piping, conduit, cabling, etc. shown on drawings shall be coordinated with air distribution devices, special ceiling, floor, and structure construction, etc. Provide additional rises and drops to those indicated on the drawings as required to coordinate with architectural, structural or mep elements shown on the contract documents. All utilities shall be routed in an orderly manner, grouped together wherever possible, and located so as to conserve building space. Ductwork, piping, conduit, cabling, etc. Shown on each plan is run above the ceiling on the floor where it is shown unless otherwise noted.
   4. No new roof penetrations.

L. As-Builts: The contractor shall maintain his set of construction drawings on site at all times so that all changes between the drawings and the actual construction can be noted on the drawings. This includes all deviations from the original contract. The contractor shall indicate all changes from the original plans made during the installation of his work in red ink on two blueline prints. At the end of construction, the contractor shall sign and date the drawings certifying that they are an accurate reflection of the actual construction. As-built drawings are to be delivered to the Architect of Record in a timely fashion after project completion. Note that the final invoice for the contract will not be paid by the owner until record drawings are received from the prime consultant.
M. All work noted "NIC" or "Not in Contract" is to be accomplished by another contractor and is not to be part of the construction agreement.

1.2 DEFINITIONS

A. Furnish: To purchase and deliver products to the project site and prepare for installation.

B. Install: To assemble, erect, secure, connect, and place furnished product into operation.

C. Provide: To furnish and install.

D. Products: Includes materials, systems, parts, and equipment.

E. Concealed: Embedded in or installed behind walls, within partitions, above suspended ceilings, in trenches, in tunnels and crawl spaces.

F. Exposed: Not installed underground or "concealed" as defined above.

G. Specifications: These specifications plus the Codes and Standards referenced herein.

1.3 CONTRACTOR QUALIFICATIONS

A. General: The firms that perform the installation of the work under this Division of specifications shall be one that maintains an established, experienced organization with a permanent, manned office within a radius of 100 miles of the project site.

B. Mechanical Firm’s Proficiency: The firm shall have trained personnel, instruments, tools, and equipment to perform the installation and maintenance service specified. The firm shall have been in business performing services as specified herein for at least three years.

C. Plumbing Firm’s Proficiency: The firm's proficiency in the installation, start up, adjustment and maintenance of plumbing systems shall have been demonstrated by the successful performance of work as specified herein on at least three systems with wall or floor mounted flush valve water closets, primary and secondary roof drainage systems, and 2 inch minimum domestic water service with reduced pressure zone backflow prevention protection. The firm shall have trained personnel, instruments, tools, and equipment to perform the installation and maintenance service specified. The firm shall have been in business performing services as specified herein for at least three years. All work shall be performed under the direct supervision of a master plumber, holding current license issued by the state of Texas.

1.4 SAFETY:

A. Contractor shall comply with all applicable safety standards including, but not limited to OSHA standards and owner’s requirements.
B. All safety exposures or violations shall be rectified immediately by the contractor. The contractor shall be responsible for providing protection of persons and property, providing safe working conditions throughout the work progress, providing temporary coverings for openings through walls or floors, and providing temporary barriers, partitions and/or dust barriers where required to maintain OSHA and the owner's safety standards and to prevent damage to property. All areas adjacent to the construction area or affected by the construction must be protected from damage, cleaned, and restored to the original condition at no additional expense to the owner. The contractor shall provide protective clothing and eyewear for all personnel who are required to handle hazardous chemical products or work in hazardous locations.

C. Submit material safety data sheets and manufacturer's current recommended method of installation for all materials used to perform the work indicated by these documents. All submittals shall be prepared according to current owner specifications and shall be approved prior to starting any work. All chemicals or chemical compounds proposed for use on the property including, but not limited to paint thinners, solvents, adhesives, sealants, cleaning compounds, epoxies, etc. Must be approved by the owner.

D. Dispose of debris, trash, and hazardous materials in accordance with all applicable codes.

E. The contractor shall be responsible for training his/her employees and subcontractors as required by the owner and in the recognition and avoidance of unsafe conditions, and in the regulations and hazards which apply to the area in which the work will take place.

F. Work areas shall be kept continuously, at all times, free of debris and non-hazardous material to the satisfaction of the project coordinator. All existing piping and conduits shall have temporary protection during construction. The contractor shall coordinate storage of materials, parking of vehicles, and restrictions of work with the project coordinator. After project completion, the site shall be cleaned up and restored to its condition or better prior to the start of the project to the satisfaction of the project coordinator.

1.5 QUALITY CONTROL

A. Comply with manufacturers’ instructions, including each step in sequence.

B. Request clarification from Engineer before proceeding, should the manufacturers’ instructions conflict with Contract Documents

C. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

D. Conform to reference standard by date of issue current on date of Contract Documents date for receiving bids, except where a specific date is established by code.
1.6 SUBMITTALS

A. Uniform General Conditions, including Supplementary General Conditions

B. DIVISION 1 – GENERAL REQUIREMENTS, Section 01000 – Special Conditions

C. Contractor shall provide product data submittals on all major equipment, components, and materials specified in these plans for engineers and owners review and acceptance prior to installation.

D. Completeness of submittal: All submittal data shall be submitted at one time unless unavailable drawings would delay job progress. In such a case long lead time items may be submitted individually ahead of the completed submittal binder and the binder, when submitted, shall have a properly labeled tab for insertion of individual submittals for the long lead time items.

E. Contractor Review: The Contractor shall check data carefully to insure compliance with these specifications prior to submitting. For product data describing two or more variants of the same model product, clearly mark the selected product and all included accessories and options. Stamp and sign each submittal section indicating review and approval and provide notes indicating any variances that exist.

F. Submittal data for other Division 22 and 23 Specification Sections: Provide data as required in each individual Division 22 and 23 Specification Sections. Submittal data types are as follow:

1. Compliance Data: Published literature, certificates, and lists indicating the product's compliance with standards referenced in these specifications.
2. Published Literature: Indicate dimensions, weights, capacities, ratings, horsepower, gages, and finishes of materials, and electrical characteristics and connection requirements.
3. Performance Data: Performance data including fan curves, pump curves, and equipment output capacities complete with rating conditions as scheduled on contract drawings. As a minimum submitted data shall include all performance data scheduled or noted on contract drawings.
4. Sound Power Level Data: Equipment sound power level at 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz octave band center frequencies plus db A weighted sound level. Data shall include distance from equipment to test equipment.
5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
6. Samples and Color Selection Charts.
7. Manufacturer's Instructions: Include installation instructions.
8. Certificates: Signed letters certifying compliance with specified requirements.
9. Calculations: Design and/or design calculations.
1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver Products to the project in manufacturer's original shipping packaging, properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Acceptance at Site: Comply with the following requirements:
   1. Inspect shipments and immediately report any damage to the carrier and to the Construction Manager so that job progress will not be delayed.
   2. All items received by the Contractor shall be left in their original containers, or as shipped with dust caps, packing materials, and weather proof covers until installed in final locations.

C. Storage and Protection: During construction maintain all delivered materials and equipment in an orderly manner and protect from damage by complying with the following minimum requirements:
   1. Products stored outside or in unheated spaces shall be covered with waterproof drop cloths or tarpaulins, and provided with blocking to raise the base of each item at least 6 inches above ground and water levels.
   2. Store electrical items that would be damaged by cold weather or condensation in a heated, enclosed space until placed into service.
   3. Products stored inside shall be protected from dirt, construction debris, welding and cutting spatters, paint dropping etc. either by original packaging or Contractor provided covers.
   4. All installed materials and equipment shall be in a like new condition. Damaged equipment or materials shall be repaired to like new conditions or replaced at no cost to the Owner.

1.8 SEQUENCING AND SCHEDULING

A. Carefully examine the architectural, HVAC, controls, and electrical drawings and specifications. Coordinate all work with other disciplines to avoid conflicts and delay of installation schedule.

B. The Contractor shall install mechanical work so as not to interfere with the work of other disciplines or trades. If work is installed that does interfere, the work shall be corrected at no additional cost to the Owner. Occupation of a work space by any trade or discipline does not give the right of priority to the space.

C. Tests: Test requirements shall be as specified in other Division 23 Specification Sections. Provide the engineer 48 hours notification in advance of any test. Engineer, at his option, may witness test. Complete tests prior to insulating or otherwise covering work. Leaks shall be repaired, defective materials replaced, and system shall be retested. No water pressure test shall be conducted in freezing weather. Conduct test prior to connecting to equipment or isolate equipment from system.
1.9 UTILITY CONNECTIONS AND PERMITS

A. Water: Make arrangements with the water utility company to provide water service and meter as shown on site plan.

B. Sanitary Sewer: Make arrangements with the sewer utility for new sewer tap and service as applicable.

C. The contractor shall be responsible for securing and paying for all permits, licenses, clearances and certificates from the owner and local authorities having jurisdiction as required prior to the commencement of the work.

D. Prior to any cutting or trenching, verify with owners rep., utility companies, and landlord that all available information is known regarding underground obstructions. Take caution when trenching not to disturb any existing utilities. Notify owners representative immediately upon uncovering unknown utilities for further direction.

1.10 COMPLETION OF WORK

A. Execute final cleaning prior to final inspection.

B. Final Cleaning: Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

C. Clean construction debris from roof.

D. Remove waste and surplus materials, rubbish, and construction facilities from the site.

E. Contractor to provide start-up and commissioning services for all new systems and equipment, as well as training services for the owner's maintenance personnel in the use of these systems and equipment. Adjust operating products and equipment to ensure smooth and correct operation.

F. Upon completion of construction, contractor shall demonstrate proper functionality of all fire smoke dampers and ahu smoke detectors to owner and/or engineer.

G. At the completion, an inspection shall be made and the entire system shall be shown to be in specified working condition. The following shall be available during the inspection:
   1. Texas Parks & Wildlife Department staff.
   2. Contractor representative.
   3. Mechanic with hand tools, ladder and flash light.
   5. Complete specifications and drawings with all addenda and revisions.

1.11 GUARANTEE AND WARRANTIES

A. All Division 23 and 22 warranty periods begin as indicated in the Uniform General Conditions. The contractor shall make provisions so that manufacturer's warranties begin on that date regardless of when equipment is delivered to the project site.
B. Warranties: Provide manufacturer's equipment warranties prior to final inspection. Length of warranty period shall be as specified in individual Division 23 Specification Sections.

C. Guarantee: All equipment and materials furnished and all work performed under this Division of specifications shall be guaranteed to be free of defective materials and workmanship for a period of one year from the date specified in A above. Upon notice from the Owner of failure of any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be promptly replaced with new parts by the Contractor at no additional cost to the Owner. All labor required to perform guarantee shall be included as part of the complete guarantee warranty.

1.12 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Contract Close-Out Record Documents: Prepare construction record documents indicating the following installed conditions:
   1. Ductwork size and location; locations of dampers, control devices, filters, air devices, terminal units, duct mounted coils, duct mounted humidifiers and duct mounted heat exchangers.
   2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, locations of flexible pipe connectors, expansion joints, anchors, and guides, hangers including attachment points, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping. Record actual locations of storage tanks, fire extinguishing components and equipment, equipment identification markings, conduit and piping routing details.
   3. Equipment locations (exposed and concealed), identification, dimensioned from prominent building lines.
   5. Submit documents to Engineer with claim for final Application for Payment.
1.13 MAINTENANCE DOCUMENTS AND INSTRUCTIONS

A. Maintenance Manuals: One bound and indexed hard copy and one bookmarked digital copy of the Operating and Maintenance Manual shall be prepared by the Contractor and be submitted to the Engineer for approval prior to delivery to operating personnel. Each manual shall contain the following information, data and drawings:

1. List of contents. Insert under front cover.
2. Copy of approved submittals, equipment, and materials.
3. Installation, operating, and maintenance instructions for each item of equipment.
4. Wiring schematics for each item of equipment.
5. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
6. Manufacturer's equipment warranties.
7. Copy of accepted Test and Balance Reports including list of instruments and description of methods employed.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 ROUGH-IN

A. Final Locations: Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Coordinate mechanical systems, equipment, and materials installation with other building components.

B. Prepare for Installation: Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

C. Deviation From Drawings: Drawings are schematic and show approximate location of equipment and materials, however, the Contractor shall obtain the Engineer's/Architect's approval before deviating from the drawings. Written dimensions shall take precedence over scaled dimensions.

3.2 MECHANICAL AND PLUMBING INSTALLATIONS

A. General: Installation shall be as specified in individual Division 22 and 23 Specification Sections and in accordance with approved manufacturer's installation instructions. Conflict between manufacturer's printed instructions and these specifications shall be brought to the attention of the Engineer/Architect.
B. Equipment: All equipment installed on this project shall be new and unused unless noted otherwise. The contractor shall remove all shipping labels, dirt, paint spots, grease, and stains from all equipment. Debris shall be removed as it accumulates. Upon completion of his work, the contractor shall clean all equipment. No loose parts or scraps of equipment shall be left on the premises.

C. Installation: Install systems, materials, and equipment to conform to approved submittal data, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect/Engineer.

1. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
2. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
3. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
4. Install systems, materials, and equipment level and plumb parallel and perpendicular to other building systems and components, following the building lines, where installed exposed in finished spaces.
5. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
6. Provide access panels or doors where units are concealed behind finished surfaces.
7. Install isolation valves at all piping branch taps (water, air, etc.).

D. Cleaning: Comply with the following cleaning requirements:

1. Upon completion of installation, piping, ducts, and equipment shall be thoroughly cleared of dirt, grease, rust and oil, primed where necessary, and left ready for painting. Vacuum clean the inside and outside of plenums and equipment cabinets.
2. Clean gages, thermometers, traps, strainers, fittings, and lavatory aerators.

E. Painting and Finishing: Comply with the following finishing requirements:

1. Contractor shall clean, spot prime with zinc chromate and entirely repaint, with original color any factory finished equipment which has rusted or been damaged.
2. Insulation coverings shall be cleaned, sized if necessary, and left ready for service identification.
3. Ferrous metal shall be cleaned and primed, ready for painting.

F. Lubrication and Packing: Comply with the following requirements:

1. Lubricate equipment with correct grade, type, and quantity of lubrication before placing equipment into service. Damages caused by not providing proper lubrication shall be repaired at Contractor's expense.
2. Each shaft or valve stem containing a packing gland shall be checked for condition and examined for proper grade, amount, and type of packing by backing packing gland off.

3. Maintain all lubrication and packing seals during construction, and assure that all are operating properly at the time of final acceptance. Replace worn gaskets and packing.

4. When filling systems initially for hydrostatic pressure tests, adjust valve packing glands to finger tight, and allow packing to absorb water for five minutes prior to tightening packing nuts.

5. All rotating pieces of equipment shall be properly lubricated prior to start-up. Damage to shafts, bearings, seals, etc., caused by lack of proper lubrication or over lubrication shall be repaired by the Contractor at no cost to the Owner.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 01 – General Requirements. In addition to the requirements specified in Division 01 Specification Sections, the following requirements apply:

1. In new construction areas, avoid cutting of concrete, masonry, and other finished work by use of sleeves and inserts.

2. Any cutting thru structural members or floors shall first be coordinated with the structural engineer.

3. Cut holes through concrete, brick, tile, etc., when necessary, by rotary core drilling.

4. During cutting and patching operations, protect adjacent installations.

5. Perform at no expense to the Owner, cutting, fitting, and patching of mechanical equipment and materials required to:
   a. Uncover Work to provide for installation of ill-timed Work.
   b. Remove and replace defective Work.
   c. Remove and replace Work not conforming to requirements of the Contract Documents.
   d. Remove samples of installed Work as specified for testing.
   e. Install equipment and materials in existing structures.
   f. Upon written instructions from the Engineer, uncover and restore Work to provide for Architect’s/Engineer’s observation of concealed Work.

6. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

7. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

8. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched. Repaired or patched surface finishes and components will match existing finishes. Use new materials.

9. All new wall and floor penetrations shall be made at 90 degree angles, unless shown otherwise, and shall be sealed fireproof with an approved
10. There shall be no drilling into the floor above or below, without first contacting the owner’s designated representative.

11. All roof penetrations are to comply with owners roofing contractors and/or roofing insurance requirements.

3.4 EXCAVATION, TRENCHING AND BACKFILL

A. Excavation:

1. The Mechanical, Plumbing and Electrical subcontractors shall perform all excavations of every description, for their particular installations and of whatever substances encountered, to the depths indicated on the Drawings and/or required for the installation of piping, conduit, utility systems, etc. All exterior lines shall be installed with a minimum cover of 24", unless otherwise indicated. Generally, more cover shall be provided if grade will permit. All excavation materials not required for backfill or fill shall be removed and wasted as acceptable to the Construction Inspector. All excavations shall be made only by open cut. The banks of trenches shall be kept as nearly vertical as possible and where required, shall be properly sheeted and braced. Trenches shall be not less than 12" wider nor more than 16" wider than the outside edges of the pipe to be laid therein, and shall be excavated true to line so that a clear space not less than 6" nor more than 8" in width is provided on each side of the pipe. For sewers, the maximum width of trench specified applies to the width at and below the level may be made as wide as necessary for sheeting and bracing, and the proper installation of the work.

2. The bottom of trenches shall be accurately graded to provide proper fall and uniform bearing and support for each section of the pipe on undisturbed soil or 2" of sand fill at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints. Bell holes shall be dug after the trench bottom has been graded. Where inverts are not shown, grading shall be determined by the National Plumbing Code for the service intended and the size used. Bell holes for lead pipe joints shall be 12" in depth below the trench bottom and shall extend from a point 6" back of the face of the bell. Such bell holes shall be of sufficient width to provide ample room for caulking. Bell holes for sewer tile and water pipe shall be excavated only to an extent sufficient to permit accurate work in the making of the joints and to ensure that the pipe, for a maximum of its length, will rest upon the prepared bottom of the trench. Depressions for joints other than bell-and-spigot shall be made in accordance with the recommendations of the joint manufacturer for the particular type of joint used. In general, grading for electrical ductbanks and conduits shall be from building to manhole, and from a high point between manholes to each manhole. Special pipe beds shall be provided as specified hereinafter.

3. The lower 4" of the pipe trenches measuring from an overhead line set parallel to the grade line of the sewer shall be excavated only a few feet in advance to the pipe laying, by men especially skilled in this type of work. Where damage is likely to result from withdrawing sheeting, the sheeting shall be left in place. Except at locations where excavation of rock from the bottom of trenches is required, care shall be taken not to excavate below the depths required. Where rock excavation is
required, the rock shall be excavated to a minimum overdepth of 6" below the trench depths specified. The overdepth rock excavation and all excess trench excavation shall be backfilled with sand. Whenever wet or otherwise unstable soil is incapable of properly supporting the pipe is encountered in the trench bottom, such soil shall be removed to a depth and for the trench lengths required, and then backfilled to trench bottom grade, as hereinafter specified, with sand.

4. All grading in the vicinity of excavation shall be controlled to prevent surface ground water from flowing into the excavations. Any water accumulated in the excavations shall be removed by pumping or other acceptable method. During excavation, material suitable for backfilling shall be stacked in an orderly manner a sufficient distance back from edges of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be wasted and removed from the job site as directed by the Construction Inspector.

5. All shoring and sheeting required to perform and protect the excavations and to safeguard employees and/or adjacent structures shall be provided.

6. Excavate as required under the building in order that all piping, ductwork, etc., shall clear the ground a minimum of 12" for a distance of 24" on either side. Edges of such excavations shall slope at an angle of not over 45 degrees with the horizontal unless otherwise approved by the Construction Inspector. The bottom of such excavation shall be graded to drain in a manner acceptable to the Construction Inspector.

7. Trenches for cast iron drain, storm water and sewer lines inside the building shall be properly excavated, following, in general, the procedures set out for exterior lines. Where floors are to be poured over these lines, they shall be backfilled, tamped and settled with water. Where no flooring is to cover the lines, they shall be backfilled to form a level grade.

8. All surplus materials removed in these trenching operations becomes the property of the contractor, and shall be disposed of at the expense of the contractor, at a legal disposal site, off of the campus.

B. Backfilling:

1. Trenches shall not be backfilled until all required tests are performed and until the piping, utilities systems, etc., as installed are certified by the Owner's inspector to conform to the requirements specified hereinafter. The trenches shall be carefully backfilled with sand to a depth of 12 inches above the top of the pipe. The next layer and subsequent layers of backfill may be excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel, soft shale, or other approved materials free from large clods of earth or stones larger than 1 1/2" in diameter, flooded until the pipe has cover of not less than one foot. The remainder of the backfill material shall then be thrown into the trenches, moistened, and tamped or flooded in one foot layers. Blasted rock, broken concrete or pavement, and large boulders shall not be used as backfill material. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and mounded over, and smoothed off.

2. Backfill under concrete slabs-on-fill shall be as specified above, shall be gravel, or shall be other such materials more suitable for the application. Installation and compaction shall be as required for compatibility with adjacent materials.
C. Opening and Re-closing Pavement and Lawns: Where excavation requires the opening of existing walks, streets, drives, other existing pavement, or lawns, such surfaces shall be cut as required to install new lines and to make new connections to existing lines. The sizes of the cut shall be held to a minimum, consistent with the work to be accomplished. After the installation of the new work is completed and the excavation has been backfilled and flooded, the area shall be patched, using materials to match those cut out. The patches shall thoroughly bond with the original surfaces and shall be level with them, and shall meet all the requirements established by the authorities having jurisdiction over such areas.

D. Excavation in Vicinity of Trees: All trees including low hanging limbs within the immediate area of construction shall be adequately protected to a height of at least 5 ft. to prevent damage from the construction operations and/or equipment. All excavation within the outermost limb radius of all trees shall be accomplished with extreme care. All roots located within this outermost limb radius shall be brought to the attention of the Construction Inspector before they are cut or damaged in any way. The Construction Inspector will give immediate instructions for the disposition of same. All stumps and roots encountered in the excavation, which are not within the outermost limb radius of existing trees, shall be cut back to a distance of not less than 18” from the outside of any concrete structure or pipeline. No chips, parts of stumps, or loose rock shall be left in the excavation. Where stumps and roots have been cut out of the excavation, clean compacted dry bank sand shall be backfilled and tamped.

END OF SECTION
SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Pipe markers.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

B. National Fire Protection Association:

1.3 SUBMITTALS

A. Product Data: Submit manufacturers catalog literature for each product required.

B. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

B. Installer: Company specializing in performing Work of this section with minimum three years’ experience.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.
PART 2 PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:
   1. Craftmark Identification Systems
   2. Safety Sign Co.
   3. Seton Identification Products

B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 PIPE MARKERS


B. Plastic Pipe Markers:
   1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:
   1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates.

E. Identify valves in main and branch piping with tags.

F. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers.
and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION
SECTION 26 00 00 - ELECTRICAL GENERAL CONDITIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes electrical materials and methods.

B. The scope of work shall include complete provisions for electrical power distribution to all lighting, devices, appliances, and equipment shown on the construction documents.
   1. Provisions include, but are not limited to, all supplies, materials, equipment, tools, and labor.
   2. Provisions also include all miscellaneous materials required to complete the work shown including, but not limited to, supports, hangers, raceways, boxes, Sleeves, seals, equipment pads, wiring connectors, terminals, labels, signs, and markers.
   3. The construction documents include all plans, elevations, details, diagrams, schedules, and notes on the drawings and the written specifications including any items mentioned in either the specifications or on the drawings but not in the other.
   4. Where used on the plans and in the specifications and where not specifically noted otherwise, the term “provide” and the term “install” shall mean furnish, install, connect, and test.
   5. Unless explicitly noted “by others” or “existing”, all items shown graphically or specified by notes and details on the plans shall be furnished, installed, connected, and tested as needed.

C. In addition to the general scope described above, the work shall include:
   1. Application for temporary and permanent electrical service, Permitting, Inspection, and payment of all associated fees.
   3. Equipment rental.
   4. Temporary construction power and lighting. GFCI receptacles shall be used for all construction power.

D. The intent of the drawings and specifications is to set forth the general requirements and equipment necessary for the functioning of the electrical system. The drawings and specifications do not provide a complete list of materials and work required. All miscellaneous electrical components required by good practice and workmanship for the complete installation of the electrical system shall be provided by the contractor.

E. Related Sections:
   1. This and all other division 26 specifications, the construction drawings, general contract provisions, and division 1 specifications shall be considered collectively as the total general requirements for the electrical equipment and electrical system installation and all special systems shown or described on the electrical or “E series” sheets.
1.2 REFERENCES

A. Materials, equipment, and the work performed shall comply with current requirements, rules and regulations of and, where applicable, be certified by the following standards, codes and organizations:
   1. American National Standards Institute (ANSI)
   3. Americans with Disabilities Act (ADA)
   4. ASHRAE/IES 90.1
   5. Institute of Electrical and Electronics Engineers (IEEE)
   9. National Electrical Manufacturer’s Code (NEMA)
   11. National Fire Protection Associations (NFPA)
   13. Underwriter’s Association (UL)
   14. Where discrepancies are found between the requirements of these standards codes, ordinances, regulations and the drawings and specifications, the contractor should notify the engineer prior to installation. Installed work that fails to comply with the requirements of the above shall be replaced at contractor's expense.

1.3 DEFINITIONS

A. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

B. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

C. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 SUBMITTALS

A. Submittal requirements shown here shall be used in conjunction with the requirements of the other specification sections. Where in conflict, the more stringent requirements shall apply.

B. For each product required to be submitted, provide the following
   1. Product Data: Submit catalog data showing manufacturer’s name and contact information, all standard features, dimensions, weights, listings and product labels, material types, finishes and clearly indicating which optional features will be provided.
      a. Include amperage and voltage ratings, over-current protective device ratings, AIC ratings, etc
      b. Where multiple sizes are listed, indicate sizes to be used.
c. Where multiple products are shown on the same page, indicate which products to be used.

2. Shop Drawings (where applicable): Manufacturer or contractor prepared drawings showing all relevant dimensions, weights, electrical and mechanical connection requirements, conduit entry points, assembly requirements, lifting requirements, lifting points, and required clearances.
   a. Include dimensioned plan views and elevations.
   b. Include all relevant electrical diagrams including schematic and interconnection diagrams for power, signal, and control wiring.

C. Submittals shall be organized by specification section, provided with a table of contents, and a cover page with all pertinent project information including contractor’s name and contact information, project name and number, and specification sections submitted.

D. Rejected submittals shall be resubmitted within 15 calendar days of notification of rejection.

E. Any equipment covered by division 26 specifications that is installed by the contractor without submittal approval and is not in compliance with the appropriate specifications shall be replaced at the contractor’s expense.

F. As-Constructed Record Drawings: The Contractor shall maintain a master set of As-Constructed Record Drawings that show changes and any other deviations from the drawings. The markups must be made as the changes are done. Fifteen (15) working days prior to Substantial Completion, these As-Built Record Drawings shall be transferred in a format acceptable to the Owner, and shall be complete and delivered to the Owner's Representative prior to final acceptance.

G. Uniform General Conditions, including Supplementary General Conditions

H. DIVISION 1 – GENERAL REQUIREMENTS, Section 01000 – Special Conditions

1.5 CLOSEOUT SUBMITTALS

A. Refer to UGC 12.1 Article 12 and Section 1.13 of the Special Conditions.

B. Provide a closeout submittal containing the following information in addition to items specified in other sections when submitting the Substantial Completion Inspection Request.
   1. As constructed drawings showing the actual locations of installed equipment, site raceways and boxes.
   2. Operation and Maintenance data
   3. Shop Drawings
   4. Test results
   5. Actual circuit arrangements at panels and equipment. Provide complete, typed as built of all panel schedules.

C. Operation and Maintenance Data: At the end of construction, provide the owner with an 8.5x11 bound manual including the following information:
   1. Provide product data as defined under submittals.
2. Provide manufacturer's installation and maintenance instructions for normal operation, routine maintenance and testing, and emergency maintenance procedures.
3. Spare parts listing; source of replacement parts and supplies; and recommended maintenance procedures and intervals.

D. Shop Drawings: Provide owner with a final draft, new copy of all shop drawings that were field modified after the original submittal was approved when submitting Substantial Completion Inspection Request.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products shown on the construction documents with minimum five years documented experience.
   1. Manufacturer shall maintain or certify an independently operated service center capable of providing training, support, parts, and maintenance services.

B. Supplier: Authorized distributor

C. Installer: A state licensed electrician with documented experience installing all equipment specified here in shall directly supervise all work. Where noted in the specifications, required by code, or required by the manufacturer, installer shall be a manufacturer trained and/or certified installer of the specific product to be installed.

D. Testing Agency: Where required by the construction documents, equipment manufacturer, or code; testing shall be performed by an agency
   1. With the documented experience and properly calibrated, fully functioning equipment.
   2. That is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL).
   3. That is acceptable to the authority having jurisdiction.
   4. Testing may be required to be performed by an independent agency. Refer to individual specification sections for detailed testing requirements.

1.7 QUALITY ASSURANCE

A. Inclusion of specific products in these specifications and on the plans does not mean that said products may be used for all applications in all environments. Products may only be used where approved either in the specification installation requirements sections or on the plans. Where the construction documents do no explicitly state what products are acceptable for an application, the most robust products specified are assumed to be the minimum requirement.

B. Regulatory Requirements
   1. The contractor shall comply with the requirements of all laws, rules, regulations, code and ordinances that have been adopted by the federal, state, and local authorities having jurisdiction (AHJ). All equipment, materials, means and methods shall be acceptable to the AHJ’s.
   2. Electrical installations shall conform to IEEE C2, NFPA 70, local codes and specified requirements herein. Equipment, materials, installation, and workmanship shall be in
accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

3. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. Standard Products
   1. Unless otherwise approved, all equipment shall be new, properly designed, from a reputable manufacturer meeting the specification qualifications, in compliance with the specification requirements, and in full working order.
   2. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.
   3. Listing and Labeling: Where required, all electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for the intended use. Testing agency shall be UL unless noted otherwise or pre-approved by owner and AHJ.
   4. Products shall have been in satisfactory commercial or industrial use prior to bid opening. The minimum time of use shall be 2 years. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. Longer periods may be specified for specific products. The product shall have been on sale on the commercial market through advertisements, manufacturers’ catalogs, or brochures during the 2-year period.

D. Material and Equipment Manufacturing Date
   1. Products manufactured more than 2 years prior to date of delivery to site shall not be used, unless specified otherwise.

E. All equipment used for testing shall be in full working order and calibrated per the manufacturer’s recommendations.

1.8 WARRANTY

A. The equipment items shall be supported by service organizations which are within 100 miles to the project site in order to render service to the equipment on a regular and emergency basis (24-hour maximum response time) during the warranty period of the contract.

1.9 COORDINATION

A. All power outages shall be coordinated in writing with the owner a minimum of one(1) week prior to the outage.

B. If the owner will occupy any portion of the facility during any period of construction, cooperate fully with the owner or his representative during construction operations to minimize conflicts and to facilitate owner usage so as not to interfere with the owner’s operations.
C. The drawings are diagrammatic. They do not show switches, power and data outlets, special systems components (FA, Access Control, AV, etc), electrical equipment, equipment connections, required raceways, etc. in their exact dimensioned locations. The contractor must carefully review the field conditions and plans to identify conflicts and areas that require coordination.

D. Coordinate electrical and special systems equipment rough in with millwork, signs, mechanical and plumbing systems, sprinkler systems, architectural and structural elements, and the owner's representative. Minor changes in electrical equipment locations and layout that are required by site conditions or order by the design team prior to performance of work shall be made by the contractor without additional charges to the owner.

E. Maintain required NEC working space and dedicated equipment spaces around all electrical equipment, control panels, etc that are subject to maintenance, testing, or user interface. Coordinate with other trades prior to installation. If clearance cannot be provided, the contractor shall notify the engineer prior to rough-in.

F. Coordinate color selections for luminaires and all device plates with owner.

G. Contractor shall be responsible for field coordinating with other trades.

H. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. To allow for the appropriate installation of furniture and equipment relative to receptacles and switches.

I. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

J. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

K. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

L. Determine connection locations and requirements.

M. Sequence rough-in of electrical connections to coordinate with installation of equipment.

N. Sequence electrical connections to coordinate with start-up of equipment.

1.10 DELIVERY STORAGE AND HANDLING

A. Store in clean, dry space located above grade and protect from dirt, water, construction debris, traffic, freeze, and where applicable, deterioration from sun light.
B. Maintain factory wrapping or provide additional canvas or plastic cover for all large electrical equipment. Follow all manufacturer recommendations for humidity and max/min temperatures for storing electrical equipment.

1.11 SAFETY

A. The Contractor shall follow all industry standard safety procedures.
   1. The Contractors shall be responsible for training all personnel under their employ in areas concerning safe work habits and construction safety. The Contractor shall continually inform personnel of hazards particular to this project and update the information as the project progresses.
   2. The Contractor shall secure all electrical rooms, to limit access, prior to energizing any high voltage switchgear and shall control access during the project after energization. The Contractor shall post and maintain warning and caution signage in areas where work is on going near energized equipment. The Contractor shall cover all energized live parts when work is not being done in the equipment. This includes lunch and breaks.
   3. The Contractor shall strictly enforce OSHA lock out/tag out procedures. Initial infractions shall result in a warning; a second infraction shall result in the removal of the workman and his foreman from the site. Continued infractions shall result in removal of the Contractor from the site.

1.12 SHORING AND EQUIPMENT SUPPORTS

A. Provide all permanent and temporary bracing, anchoring, supports, and shoring required to firmly stabilize and secure all raceways, boxes, enclosure, equipment, and devices.

B. Provide free standing racks to supports equipment. Racks shall be securely bolted to the floor, wall, and or ceilings. Where secured to only one surface, provide angle bracing so that racks have a minimum of 4 attachment points.

C. Provide concrete housekeeping pads for floor mounted electrical equipment. Coordinate with flooring contractor for installation.
   1. 3000PSI, with rebar reinforcement.
   2. Provide dowels for connection to new or existing adjacent slabs
   3. Pad shall be 4” thick and protrude a minimum of 1” beyond the edge of equipment.
   4. Chamfer top edges of slab

1.13 TEMPORARY CONSTRUCTION POWER AND LIGHTING

A. Provide temporary power service per utility company specifications
   1. Contractor shall be responsible for securing permits and coordinating temporary service with utility provider.
   2. Provide temporary power service pole per utility company specifications.
   3. Provide service feeder from temporary service point to construction trailers and power distribution assemblies to serve power tools and construction equipment.

B. Provide panel or assembly containing GFCI receptacles for power tools to be used on site.
C. Provide temporary power cables neatly trained and protected from damage.

D. Provide temporary lighting throughout area of construction. Install at ceiling level out of way of construction work.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Equipment to be installed outdoors, in corrosive or hazardous environments shall be rated for the intended use.

B. Compliance with the requirements of the contract documents shall not relieve the contractor of the responsibility of providing equipment that is new, properly designed, from a reputable manufacturer, and in full working order.

C. If conflicts occur between the specifications and drawings, the higher quality, price or quantity shall be provided and installed.

D. If there is any question as to quality, size or quantity necessary, the contractor shall provide a written request for clarification from the Engineer. Contractor shall be responsible for any additional expenses incurred as a result of the contractor’s failure to obtain clarification.

E. Detailed product specifications are included in other specification section and on the plans.

2.2 FINISHES

A. Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

B. Raceways, boxes, supports, etc shall be galvanized: gold, silver, or hot dipped, unless noted otherwise.
   1. Do not use pre-galvanized products that are formed, cut, or punched after galvanization.
   2. Do not use hot dip galvanized threaded products.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time,
PART 3  EXECUTION

3.1  FIELD APPLIED PAINTING

A. Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.2  FIELD PROGRAMMING

A. Electrical contractor shall be responsible for the coordination and payment of programming for all programmable devices and equipment including, but not limited to, lighting controls, circuit breakers, etc.

B. Where required, the manufacturer of the product shall be engaged to perform the programming.

3.3  EXAMINATION

A. If a conflict is found between the specification and plans, notify the A/E of the conflict.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

C. Verify existing conditions are as shown on the plans and that adequate space is available for the equipment for installation.

3.4  EXISTING WORK

A. Maintain in service existing systems that are required for life safety or ongoing operations during construction.

B. Remove exposed abandoned equipment wiring connections, conduit, and boxes, including abandoned connections, conduit, and boxes above accessible ceiling finishes.

C. Disconnect abandoned utilization equipment and remove wiring connections. Remove abandoned components when connected raceway is abandoned and removed. Install blank cover for abandoned boxes and enclosures not removed.

D. Extend existing equipment connections using materials and methods compatible with existing electrical installations, or as specified.

E. Contractor to remove all abandoned wire near the surface and leave all wiring buried in place.

3.5  INSTALLATION

A. The installation requirements shown here are general scope requirements. More detailed information is provided for each of these topics in other specifications and on the plans.
B. No foreign systems such as piping, duct work, etc shall be installed above electrical equipment.

C. Grounding and Bonding
   1. All circuits shall be provided with NEC compliant green ground conductor sized per NEC 250, UNO.
   2. All equipment shall be properly bonded.
   3. Provide grounding electrodes as specified on plans and as required by code.

D. Raceways, Boxes and Enclosures
   1. Provide complete raceway systems from source to all loads with dedicated supports for each raceway element.
   2. Provide all required back boxes and supports for wiring devices, sensors, etc.
   3. Provide pull box at appropriate locations for all power and special systems raceways whether shown on plans or not.

E. Electrical connections and terminations.
   1. Make all connections and terminations within the power distribution system and between the distribution system and the equipment served.
   2. Make conduit connections to vibrating equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
   3. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
   4. Provide calibrated torque wrenches and screwdrivers and tighten terminals, lugs and bus joints using it.

F. Equipment wiring requirements
   1. Install disconnect switches, controllers, control stations, and control devices as required for equipment.
   2. Install terminal block jumpers to complete equipment wiring requirements.
   3. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

G. Identification
   1. Provide appropriate labels for all equipment, wiring devices, conductors, cables, box, and enclosures
   2. Provide warning signs for electrical equipment and buried circuits.

H. Code and manufacturer requirement compliance
   1. Install work in compliance with the latest edition of the NEC, City and Owner design criteria manuals, and the authority having jurisdiction.
   2. Apply, install, connect, erect, use, clean, adjust, and condition materials and equipment as recommended by the manufacturers in their published literature.
   3. All terminals, lugs and bus joints shall be tightened per the manufacturer's torque recommendations.

I. Arrangement and planning
   1. Arrange electrical work in neat, well-organized manner.
   2. Do not block future connection points of electrical service.
3. Install all electrical work parallel or perpendicular to building lines unless noted otherwise, properly supported with purpose-designed apparatus, in a neat manner.

4. Maintain required NEC working space and dedicated equipment spaces around all electrical equipment subject to maintenance, testing, or user interface. Coordinate with other trades prior to installation.

5. Do not block equipment control panels with lighting, raceways, structural elements or other equipment. Orient equipment so that control panels do not face structural elements or other equipment that will restrict access.

6. Coordinate with engineer before installation if any of the above conditions can not be met due to undiscovered site conditions or if locations shown on plans are field determined to be in conflict with equipment and structures called for on other plans.

J. Cutting and Patching

1. Make opening through masonry and concrete by core drilling in acceptable locations. Restore openings to original condition to match remaining surrounding materials.

2. Provide sleeves for penetrations through floors and walls

3. Seal all openings using appropriate materials

4. Where existing conditions are not documented, perform ground penetrating radar scan of structural element to be cut.

END OF DOCUMENT
SECTION 26 05 19 - CONDUCTORS AND CABLES 600V OR LESS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes building wire and cable; service entrance cable; metal clad cable; and wiring connectors and connections.

1.2 REFERENCES

A. International Electrical Testing Association:

B. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

C. Uniform General Conditions, including Supplementary General Conditions.

D. Division 1 – General Requirements, Section 01000 – Special Conditions.

1.3 SUBMITTALS

A. Product Data: Submit catalog data showing all standard features, dimensions, weights, listings and product labels, material types, finishes and clearly indicating which optional features will be provided.
   1. Include amperage and voltage ratings.
   2. Where multiple sizes are listed, indicate sizes to be used.
   3. Where multiple products are shown on the same page, indicate which products to be used.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and circuits.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: A licensed electrician with documented experience installing all equipment specified here in shall directly supervise all work. Where noted in the specifications or required by the manufacturer, installer shall be a manufacturer trained and/or certified installer of the specific product to be installed.
1.6 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Perform Work in accordance with all applicable state and federal requirements.

C. Maintain one copy of each document on site.

D. Source Limitations: All components required for a complete functioning system as described here in shall be obtained through one source from a single manufacturer.

E. Listing and Labeling: Where required, all electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for the intended use. Testing agency shall be UL unless noted otherwise or pre-approved by owner and AHJ.

1.7 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.8 COORDINATION

A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

B. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
   1. Solid, insulated conductor in raceway for feeders and branch circuits 10 AWG and smaller.
   2. Stranded, insulated conductors in raceway for feeders and branch circuits 8 AWG and larger
   3. Stranded, insulated conductors for control circuits. Route in raceway, except were otherwise allowed to be run exposed in plenum, in tray, etc.
   4. Conductor not smaller than 12 AWG for power and lighting circuits.
   5. Conductor not smaller than 14 AWG for control circuits.

B. Wiring Methods: Provide the following wiring methods:
   1. Concealed and Exposed Dry, Wet, or Damp Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
   2. Exterior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
3. Underground Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

2.2 BUILDING WIRE

A. Manufacturers:
   1. AETNA
   2. American Insulated Wire Corp.
   3. Colonial Wire Model
   4. Encore Wire Model
   5. General Cable Co. Model
   6. Republic Wire Model
   7. Rome Cable Model
   8. Service Wire Co. Model
   9. Southwire Model
   10. Superior Essex Model
   11. Substitutions: With engineer approval.

B. Product Description: Single conductor insulated wire.
   2. Insulation Voltage Rating: 600 volts.
   3. Insulation Temperature Rating: 90 degrees C.
   4. Insulation Material: Thermoplastic. Type THHN/THWN U.N.O.

C. Grounding conductors, where insulated, shall be colored solid green or identified with green color as required by the NEC. Conductors intended as a neutral shall be colored solid white, or identified as required by the NEC. All motor or equipment power wiring shall be colored according to Section 26 05 53, Electrical Identification.

2.3 METAL CLAD CABLE

A. Manufacturers:
   1. Diamond Wire & Cable Co.
   2. Essex Group Inc.
   3. General Cable Co.
   4. Substitutions: With engineer approval.

B. Product Description:
   2. Insulation Voltage Rating: 600 volts.
   3. Insulation Temperature Rating: 90 degrees C.
   4. Insulation Material: Thermoplastic. Type THHN/THWN U.N.O.

C. Armor Material: Steel.

D. Armor Design: Interlocked metal tape

E. Jacket: Where required.
2.4 WIRING CONNECTORS

A. Provide factory-fabricated, metal connectors of the size, rating, material, type and class as required by manufacturer of the equipment and the NEC. The following types, classes, kinds and styles should be used only where appropriate and as noted:
   1. Solderless Pressure Connectors
   2. Crimp
   3. Threaded
   4. Insulated Spring Wire Connectors with plastic caps for 10 AWG and smaller
   5. Split bolt parallel connectors
   6. Pre-insulated multi-tap connectors
   7. Epoxy resin type splicing kits.

B. Wiring connectors shall be insulated to 600V. Conducting components shall match conducting material of wiring (copper, unless noted otherwise).

2.5 TERMINATIONS

A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

C. Control wiring: Use insulated terminals for control wiring. Use flange spade compression terminal for termination of stranded conductors at wiring devices, including grounding connections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify interior of building has been protected from weather.

B. Verify mechanical work likely to damage wire and cable has been completed.

C. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

B. Clean conductor surfaces before installing lugs and connectors.

3.3 EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.
B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.

C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

D. Extend existing circuits using materials and methods compatible with existing electrical installations, or as specified.

E. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

3.4 INSTALLATION

A. Neatly train and lace wiring inside boxes, equipment, and panelboards.

B. Install electrical cable, wire and connectors as indicated, in accordance with the manufacturer’s written instructions, the applicable requirements of NEC and the National Electrical Contractors Association’s “Standard of Installation”, and as required to ensure that products serve the intended functions.

C. Wiring Installation in Raceways
   1. Wire and cable shall be pulled into clean dry conduit. Do not exceed manufacturer’s recommended values for maximum pulling tension.
   2. Do not install the conductors until the raceway system is complete and properly cleaned.
   3. Pull conductors together where more than one is being installed in a raceway.
   4. Use UL listed pulling compound or lubricant, when necessary; compound must not deteriorate conductor and insulation.
   5. Do not use a pulling means, including fish tape, cable or rope, which can damage the raceway.
   6. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
   7. Place an equal number of conductors for each phase of a circuit in same raceway.
   8. Provide separate conduit or raceway for line and load conductors of motor starters, safety disconnect switches, and similar devices. Those devices shall not share the same raceway.
   9. All conduits shall contain a green grounding conductor. Conduit, wireways, or boxes shall not be used as the equipment grounding conductor.

D. Cable:
   1. Protect exposed cable from damage.
   2. Support cables above accessible ceiling, using spring metal clips or appropriate cable ties to support cables from structure. Do not rest cable on ceiling panels.
   3. Use suitable cable fittings and connectors.

E. Wiring Connections and Terminations
1. Install splices, taps and terminations, which have equivalent-or-better mechanical strength and insulation as the conductor. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

2. Keep conductor splices and taps accessible and to a minimum. Splice branch circuits only in accessible junction or outlet boxes. Where terminations of cables that are installed under this Section are to be made by others, provide pigtail of adequate length for neat, trained and bundles connections, minimum 5 feet at each location, unless noted otherwise on drawings.

3. Splices below grade are not allowed unless it is not possible.

4. Use splice, tap and termination connectors, which are compatible with the conductor material.

5. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

6. Tape un-insulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor and label as spare.

7. Power and Lighting Circuits:
   a. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and larger.
   b. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps on lighting and receptacle circuits.
   c. Use split bolt connectors for copper wire splices and taps, 6 AWG and larger.

8. Connections for all wire sizes in motor terminal boxes where the motor leads are furnished with crimped-on lugs shall be made by installing ring type compression terminals on the motor branch circuit ends and then bolting the proper pairs of lugs together. First one layer of No. 33 scotch tape reversed (sticky side out), then a layer of rubber tape, then two layers of No. 33 half-lapped.

F. Terminal Lugs
   1. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.
   2. Size lugs in accordance with manufacturer’s recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.
   3. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

G. Voltage Drop
   1. No conductor smaller than No. 12 wire shall be used for lighting purposes. In the case of “home runs” over 50’ length (100’ for 277 volt) no conductor smaller than a No. 10 wire shall be used.
   2. Voltage drop on feeders and branch circuits shall not exceed 5%.
   3. Voltage drop on control circuits shall not exceed the requirements of the equipment that the wiring serves.

H. Wiring Within An Enclosure:
   1. Contractor shall bundle AC and DC wiring separately within an enclosure.
   2. The Contractor shall utilize panel wire-ways when they are provided.
   3. Where wireways are not provided, the Contractor shall neatly tag and bundle wires and secure to sub-panel at a minimum of every three inches.
I. Separate neutral conductors shall be provided for each single phase circuit.

J. Where terminations of cables that are installed under this Section are to be made by others, provide pigtail of adequate length for neat, trained and bundles connections, minimum 5 feet at each location, unless noted otherwise on drawings.

K. Do not band any conductor either permanently or temporarily during installation to radii less than four times the outer diameter of 600-volt insulated conductors.

3.5 WIRE COLOR

A. General:
   1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the current color system in place at the facility.
   2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Use colors listed above.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
   1. For 6 AWG and smaller: Green.
   2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.6 FIELD QUALITY CONTROL

A. Before final acceptance, the Contractor shall make voltage, insulation, and load tests, necessary to demonstrate to the Owner’s representative the satisfactory installation and proper performance of all circuits.

B. All terminations rated 60A or larger shall be made using a torque wrench and the results recorded in a log to be provided to owner with closeout documents.

   1. 500V DC megger testing is required on all feeders #1/0 AWG and larger after installed in conduit.
   2. All testing shall be witnessed by TPWD representatives and all test results shall be documented in writing and signed by the electrician.
   3. Test results below 50 megohms shall be cause for rejection of the wiring installation.
   4. Replace and retest all non-compliant conductors.
   5. Provide written log of testing results to owner with closeout documents.
SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.1 SUMMARY

A. Section Includes:
   1. Rod electrodes.
   2. Active electrodes.
   3. Wire.
   4. Mechanical connectors.
   5. Exothermic connections.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:

C. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

D. Uniform General Conditions, including Supplementary General Conditions.

E. Division 1 – General Requirements, Section 01000 – Special Conditions

1.3 SUBMITTALS

A. Product Data: Submit catalog data showing all standard features, dimensions, weights, listings and product labels, material types, finishes and clearly indicating which optional features will be provided.
   1. Include amperage ratings, voltage, over-current protective device ratings, AIC ratings.
   2. Where multiple sizes are listed, indicate sizes to be used.
   3. Where multiple products are shown on the same page, indicate which products to be used.

B. Manufacturer's Installation Instructions: Submit for active electrodes.

C. Manufacturer's Certificate: Certify, Products meet or exceed specified requirements.
1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and grounding electrodes.

B. Field Quality-Control Test Reports: Report certified by field testing agent indicating results of performance testing required in Part 3 and/or on plans. Indicate overall resistance to ground and resistance of each electrode.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: A State of Texas licensed electrician with documented experience installing all equipment specified here in shall directly supervise all work. Where noted in the specifications or required by the manufacturer, installer shall be a manufacturer trained and/or certified installer of the specific product to be installed.

C. Equipment Testing Agency Qualifications: An agency, with the experience and capability to conduct the testing indicated, that is a member of a nationally recognized testing agency and that is acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Listing and Labeling: Where required, all electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for the intended use. Testing agency shall be UL unless noted otherwise or pre-approved by owner and AHJ.

C. Source Limitations: All components required for a complete functioning system as described here in shall be obtained through one source from a single manufacturer.

D. Maintain one copy of each document on site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer’s identification.

B. Store in clean, dry space located above grade and protect from dirt, water, construction debris, traffic, chemical and mechanical damage, freeze, and where applicable, deterioration from sunlight. Store in original packaging where possible.

C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.
1.8 **COORDINATION**

A. Complete grounding and bonding of building reinforcing steel prior to concrete placement.

**PART 2 PRODUCTS**

2.1 **MANUFACTURERS**

A. Products that are compliant with these specifications and produced by the following manufacturers are acceptable
   1. Copperweld, Inc
   2. Erico, Inc.
   3. ILSCO Corporation
   4. O-Z Gedney Co.
   5. Thomas & Betts, Electrical.

B. Substitutions: With prior approval from engineer.

2.2 **GROUNDING AND BONDING WIRE**

A. Material:
   1. Match building wiring material specifications
   2. Except where noted bare, match building wiring insulation.
   4. Solid copper may be used for #8 AWG and smaller.

B. Grounding Electrode Conductor: stranded Copper conductor bare.

C. Grounding Straps: Tin plated copper braided cable, 1" thick x 0.1" thick (min), #1 awg, with ¾" one hole connections on both ends (note: other connection types may be noted on plans)

2.3 **MECHANICAL CONNECTORS**

A. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

B. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

C. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
2.4 EXOTHERMIC CONNECTIONS

A. Product Description: Exothermic welding kits, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils and surface contaminants at connection points.

3.3 EXISTING WORK

A. Modify existing grounding system to maintain continuity to accommodate renovations.

B. Extend existing grounding system using materials and methods compatible with existing electrical installations, or as specified.

3.4 INSTALLATION

A. Permanently ground and bond the entire light and power system in accordance with NEC, including service equipment, feeders and branch circuits electrical panels, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

B. General Requirements

1. Install in accordance with IEEE 142, NEC requirements, and manufacturer’s recommendations.

2. Install grounding and bonding conductors concealed from view.

3. Routing of grounding electrode, special systems ground conductors, and other grounds not routed in feeders or branch circuit raceways shall be installed in a dedicated metal conduit in all locations subject to physical abuse or environmental deterioration such as exterior mounted, exposed below ceiling, etc.

4. Ground system using separate insulated grounding conductor installed with every feeder and branch circuit conductors in conduits. Terminate each end on suitable lug, bus, or bushing.

5. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes, equipment ground terminal, or metal enclosures of equipment.

6. Raceway systems shall be made continuous from source to load.

   a. Provide bonding jumpers where raceway system is inherently discontinuous such as where conduits terminate at cable trays.
b. Raceway shall be made continuous using mechanical connections that have been securely tightened using the appropriate tool. Hand tight is not acceptable.

7. Permanently attach equipment and grounding conductors prior to energizing equipment.
8. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors
9. Provide grounding bushings for conduit terminations at panels, electrical equipment, enclosures, etc.

C. Bonding Straps and Jumpers:
   1. Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
   2. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   3. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
   4. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
   5. Bond the following components to the grounding electrode
      a. System neutral at service entrance and transformer secondaries
      b. Service equipment enclosures, exposed non-current carrying metal parts of electrical equipment
      c. Metal raceway systems, cable trays, auxiliary gutters, meter fittings, boxes, cable armor, cable sheath
      d. Ground bus in electrical rooms and IT rooms

D. Conductor Terminations and Connections:
   2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Exothermic connection.
   4. Ground wire taps in pull boxes: Mechanical connection with wet location heat shrink covering.

3.5 FIELD QUALITY CONTROL

A. Grounding System Resistance: 5 ohms maximum.

B. Perform ground resistance testing
   1. Test in accordance with IEEE 142 using a test instrument equal to AEMC Model #3710 or fall-of-potential test.
   2. Provide additional grounding electrodes as required to achieve resistance listed above.
   3. Testing shall be performed when the soil is dry and there has been no rain in the past 48 hours.

C. Perform continuity testing in accordance with IEEE 142.
D. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION
SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This section includes:
   1. Conduit supports.
   2. Formed steel channel.
   4. Equipment bases and supports.

1.2 REFERENCES

A. FM Global:

B. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

C. Underwriters Laboratories Inc.

D. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

E. Uniform General Conditions, including Supplementary General Conditions.

F. Division 1 – General Requirements, Section 01000 – Special Conditions

1.3 SUBMITTALS

A. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

B. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Supplier: Authorized distributor

C. Installer: A licensed electrician with documented experience installing all equipment specified here in shall directly supervise all work. Where noted in the specifications or
required by the manufacturer, installer shall be a manufacturer trained and/or certified installer of the specific product to be installed.

1.5 QUALITY ASSURANCE

A. Source Limitations: All components required for a complete functioning system as described here in shall be obtained through one source from a single manufacturer.

B. Listing and Labeling: Where required, all electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for the intended use. Testing agency shall be UL unless noted otherwise or pre-approved by owner and AHJ.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:
   1. Allied Tube & Conduit Corp.
   2. Electroline Manufacturing Company
   3. O-Z Gedney Co.
   4. Thomas & Betts
   5. Substitutions: With prior engineer approval.

B. Conduit straps - general purpose:
   1. One hole stainless steel for surface mounted conduits 1” or less.
   2. Two hole stainless steel for surface mounted conduits greater than 1”

2.2 CABLE TIES

A. High strength nylon temperature rated to 185 degrees F.

B. Self Locking

2.3 FORMED CHANNEL

A. Manufacturers:
   1. Allied Tube & Conduit Corp.
   2. B-Line Systems
   3. Midland Ross Corporation, Electrical Products Division
4. Thomas & Betts
5. Unistrut Corp.

B. Product Description:
1. Corrosion resistant stainless steel or fiberglass channel.
2. Holes 1-1/2 to 2 inches on center.
3. Provide angle brackets and other accessories from the same manufacture and from the same materials with the same finish

C. Provide heavier gage channel where the weight of the equipment exceeds the ratings of the products specified above.

D. Pipe Straps
1. Provide straps from the same manufacturer and of the same material and finish as channel
2. Bolt head combination slot and hex head with square nut
3. Conduit size engraved in strap for easy identifications
4. Design load of 500lbs min.

2.4 SPRING STEEL CLIPS

A. Product Description: Mounting hole and screw closure.

2.5 BOX SUPPORTS

A. Outlet boxes
1. Provide between stud box mounting brackets secured to the two adjacent studs.
2. Provide two self tapping screws on each side to secure bracket to stud
3. Where two studs are not available, provide far side box support strap

B. Pull and Junction boxes
1. Provide threaded hangers and channel supports for pull and junction boxes suspended from ceiling

PART 3 EXECUTION

3.1 PREPARATION

A. Remove incompatible materials affecting bond.

B. Obtain permission from Architect/Engineer before using powder-actuated anchors.

C. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.2 INSTALLATION - HANGERS AND SUPPORTS

A. General Requirements
1. Support raceways using corrosion resistant galvanized steel or malleable iron straps, channel, and/or beam/pipe clamps as appropriate.

2. Install conduit and raceway support and spacing in accordance with NEC.
   a. Provide supports at all boxes, electrical equipment, and loads
   b. Provide supports at code required intervals along raceways.

3. Support independent of other systems. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

4. Install multiple conduit runs on common hangers. Provide spare capacity on support elements where more than three conduits are grouped together.

B. Anchors and Fasteners:

   1. Concrete Structural Elements: Provide precast inserts, expansion anchors and preset inserts.

   2. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.

   3. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.


C. Inserts:

   1. Install inserts for placement in concrete forms.

   2. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

   3. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut.

D. Supports:

   1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.

   2. Install surface mounted boxes, cabinets, and panelboards with minimum of four anchors.

   3. Install surface mounted device boxes with a minimum of two anchors, secure boxes in stud walls to the studs on both sides of the box.

   4. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

   5. Support vertical conduit at every floor.

3.3 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of 3000 PSI concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members or formed steel channel. Brace and fasten with flanges bolted to structure.
3.4 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION
SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Conduit and tubing
   2. Surface raceways
   3. Wireways
   4. Outlet boxes
   5. Pull and junction boxes
   6. Enclosures and Cabinets

B. Related Sections:
   1. The requirements of this specification shall be followed when installing raceway for all mechanical, controls, electrical, and special systems work covered by other specifications.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
   2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.

B. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
   5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

C. Underwriters Laboratories Inc.:
   1. Products shall be listed where required by the NEC
   2. Fire-stopping products shall be listed.

D. Uniform General Conditions, including Supplementary General Conditions.

E. Division 1 – General Requirements, Section 01000 – Special Conditions.
1.3 SUBMITTALS

A. Product Data: Submit catalog data showing all standard features, dimensions, weights, listings and product labels, and clearly indicating which optional features will be provided for the following items:
   1. Metal conduit
   2. Flexible metal conduit.
   3. Liquidtight flexible metal conduit.
   5. Raceway fittings and supports.
   6. Conduit bodies.
   7. Surface raceway.
   8. Wireway.
   9. Pull and junction boxes.
  10. Enclosures and cabinets
  11. Handholes.

B. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents:
   1. Record actual routing of all underground conduits.
   2. Record actual locations and mounting heights of outlet, pull, and junction boxes larger than 4”x4”.

1.5 COORDINATION

A. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: A state licensed electrician with documented experience installing all equipment specified here in shall directly supervise all work. Where noted in the specifications, required by core, or required by the manufacturer, installer shall be a manufacturer trained and/or certified installer of the specific product to be installed.

1.7 QUALITY ASSURANCE

A. Listing and Labeling: Where required, all electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing
agency acceptable to authorities having jurisdiction and marked for the intended use. Testing agency shall be UL unless noted otherwise or pre-approved by owner and AHJ.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space located above grade and protect from dirt, water, construction debris, traffic, freeze, and where applicable, deterioration from sunlight.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to the requirements of the specifications, products by the following manufacturers may be used for raceways and boxes. UL listed substitutions that are compliant with these specifications are acceptable provided compliance with all specification requirements are clearly indicated on the submittal.

1. Apleton
2. Carlon Electrical Products
3. Hubbell Wiring Devices
4. Thomas & Betts Corp.
5. Walker Systems Inc.
6. The Wiremold Co.
7. Wheatland Tube Company
8. Allied Tube & Conduit
9. B I A
10. Cantex
11. Southwire
12. Eastern
13. Pass & Seymour
14. Hoffman

2.2 SYSTEM DESCRIPTION

A. Provide raceway and boxes as specified below for power and lighting.
1. Provide raceway and boxes for all building wiring, equipment; lighting; and wiring devices shown on plans.
2. Provide raceway and boxes at other locations as required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground:
1. Provide wrapped rigid steel conduit for 1” or larger elbows and where entering and exiting slabs or ground to 6” above ground.
2. Provide Schedule 80 nonmetallic conduit for straight runs that are buried and/or in concrete.
4. Provide boxes for utility service conduit or cabling per utility provider’s specifications
5. Provide rigid steel conduit within 5 ft of building foundation.

C. In Concrete:
   1. Provide wrapped rigid steel conduit for 1” or larger elbows and where entering or exiting concrete.
   2. Provide thick-wall nonmetallic conduit for straight runs in concrete.
   3. Provide high-grade plastic boxes or polymer concrete boxes. Nonmetallic may be used with engineer approval.
   4. Use concrete tight, masonry rated boxes and fittings were installed in concrete, stone, brick, or CMU.

D. Exterior Above Grade and Wet/Damp Interior Locations:
   1. Provide rigid steel conduit and fittings.
   2. Provide cast metal outlet, junction, and pull boxes boxes, gasketed, rated NEMA 3R min.

E. Concealed Dry Interior Locations:
   1. Provide rigid steel conduit, intermediate metal conduit, or electrical metallic tubing.
   2. Provide sheet-metal boxes.

F. Exposed Dry Interior Locations:
   1. Provide rigid steel conduit below 10 feet, and rigid steel, intermediate metal, or electrical metallic tubing above 10 feet.
   2. Provide sheet-metal boxes.

2.3 METAL CONDUIT

A. Rigid Steel Conduit:
   1. ANSI C80.1.
   3. Continuously welded seems.
   4. Uniform wall thickness and cross section.
   5. Manufacturer applied lubricating and corrosion retarding coating applied to interior of conduit.

B. Intermediate Metal Conduit (IMC): Rigid steel.

C. Fittings and Conduit Bodies:
   1. NEMA FB 1
   2. Material to match conduit.
   3. Couplings and connectors: threaded
   4. Expansion Fittings: OZ Type DX, concrete tight, provide for ¾” movement in all directions and or 30 degrees deflection in any direction

2.4 PVC COATED METAL CONDUIT

A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 20 mil thick.
B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.5 FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction.

B. Fittings: NEMA FB 1.

C. FMC shall be used in the following locations
   1. For lighting whips
   2. For connections to vibrating equipment
   3. In applications where rigid conduit cannot be installed without extensive demolition, but only with engineer’s approval.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction with PVC jacket.

B. Fittings: NEMA FB 1.

C. Use LFMC for all exterior vibrating equipment loads and in pump rooms that contain large quantities of mechanical and plumbing piping in the vicinity of the flex conduit.

2.7 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description:
   1. ANSI C80.3
   2. Material: galvanized tubing, manufactured from mild steel
   3. Continuously welded seems
   4. Uniform wall thickness and cross section
   5. Manufacturer applied lubricating and corrosion retarding coating applied to interior of conduit

B. Fittings and Conduit Bodies:
   1. NEMA FB 1
   2. Material: zinc plated steel
   3. Concrete tight
   5. Expansion Fittings: OZ Type TX

2.8 NONMETALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 and 80 PVC.
   1. Schedule 40 PVC may be used where buried or embedded.
   2. Use schedule 80 PVC conduit for any exposed exterior or interior applications requiring corrosive resistant PVC conduit such as pool pump rooms.

B. Fittings and Conduit Bodies: NEMA TC 3.
2.9 **WIREWAY**

A. Wireways shall be of steel construction general purpose for indoor spaces and rain tight for outdoor applications with knockouts.

B. Knockouts: Manufacturer's standard.

C. Size: as indicated on Drawings.

D. Cover: Hinged cover with full gaskets.

E. Fittings: Lay-in type with removable top, bottom, and side; captive screws.

F. Finish: Rust inhibiting primer coating with gray enamel finish.

2.10 **OUTLET BOXES**

A. Sheet Metal Outlet Boxes:
   1. NEMA OS 1
   3. 4”x4”, 2” deep, unless noted otherwise
   4. Concentric knockouts
   5. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
   6. Concrete Ceiling Boxes: Concrete type.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Cast Boxes: NEMA FB 1, Type FD, aluminum or cast feralloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

D. Wall Plates for Finished Areas: As specified in Section 26 27 26.

E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

F. Outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, mud rings extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual situations.

G. Provide multi-gang outlets of single box design. Sectional boxes are not acceptable. Provide outlet boxes of sufficient volume to accommodate the number of conductors entering the box in accordance with the requirements of NEC, and not less than 1-1/2 inch deep unless shallower boxes are required by structural conditions and are approved by the A/E.

H. Provide deep type cast metal weatherproof exterior outlet wiring boxes of the type, shape and size, including depth of box, with threaded conduit ends, cast metal face plate with spring-hinged waterproof cap suitably configured for each application, including face
plate gasket and fasteners. Provide PVC type outlet boxes only in corrosive areas rated as NEMA 4X.

### 2.11 PULL AND JUNCTION BOXES

**A. Sheet Metal Boxes:** NEMA OS 1, galvanized steel. Screw on cover, welded seams, stainless nuts, bolts, screws and washers.
1. Boxes larger than 12 inches in any dimension shall be panelboard code gauze galvanized steel with hinged cover.
2. Boxes shall be sized in accordance with NEC.

**B. Hinged Enclosures:** Provide hinged covers for enclosures larger than 4”. Coordinate with engineer if screw type covers must be used for any reason.

**C. Surface Mounted Cast Metal Box:** NEMA 250, Type 4X; flat-flanged, surface mounted junction box:
1. Material: Galvanized cast iron. Cast aluminum may be used with engineer approval.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

**D. In-Ground Polymer Concrete Boxes**
1. Selectively graded aggregates in combination with a polymer resin reinforced with fiberglass.
2. Provide a bottom with drain and a min 12”x12” gravel sump below drain opening.
3. Conform to all test provisions of the most current ANSI/SCTE 77 specifications for underground enclosure integrity.
4. Cover: Diamond plate, steel cover, and stainless steel cover screws.
5. Cover Legend: "ELECTRIC"
6. Box shall be traffic rated unless located in a position that is physically inaccessible to vehicular traffic.

**E. Fiberglass Concrete composite Handholes:** Die-molded, glass-fiber hand holes:
1. 12”x8” min dimensions.
2. Cover: Glass-fiber concrete composite, weatherproof cover with nonskid finish.
3. Use only where specifically noted as allowed.

### 2.12 ENCLOSURES AND CABINETS

**A. Construction:** NEMA 250, Type 1 steel enclosure.
1. Use NEMA 3R in wet locations
2. Use NEMA 4X in corrosive locations.

**B. Covers:** Continuous hinge, held closed by flush latch operable by key

**C. Furnish interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.**
D. Provide wire management systems, terminal strips, and partitions as required for complete functioning of the system.

E. Enclosure Finish: Manufacturer’s standard enamel

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

E. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION

A. Provide complete raceway systems from source to all loads with dedicated supports for each raceway element.

B. Provide all required back boxes and supports for wiring devices, telecommunications, fire alarm, access control, controls equipment, alarms, sensors, etc.

C. Provide pull box at appropriate locations for all power and special systems raceways whether shown on plans or not.

D. Arrange raceway and boxes to present a neat appearance; allow for future expansion; provide access where needed; and maintain headroom and clearances for equipment, egress, etc.

E. Fasten raceway and box supports to structure and finishes in accordance with all requirements of the NEC and the construction documents.

F. Ground and bond raceway and boxes in accordance with all requirements of the NEC and the construction documents.
G. Identify raceway and boxes in accordance with all requirements of the NEC and the construction documents.

H. Paint exposed raceway and boxes to match the surface to which they are attached.

3.4 INSTALLATION - RACEWAY

A. Raceway Supports
1. Support raceway using galvanized steel, malleable iron straps, or channel and pipe clamps.
2. Provide support at each junction box, panel and load.
3. Provide supports at intervals per code and manufacturer recommendations.
4. Group related raceway and support using steel channel conduit rack. Provide space on each for 25 percent additional raceways.
5. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.
6. Do not attach raceway to ceiling support wires or other piping systems such as sprinkler or HVAC piping or duct work.
7. Support cables in vertical raceways per NEC 300.19.
8. Construct wireway supports from steel channel.
9. Arrange raceway supports to prevent misalignment during wiring installation.
10. Additional supporting requirements are specified in other specification sections.

B. Raceway Routing
1. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
2. The conduit routing shown on the construction documents is diagrammatic.
   a. Coordinate interior routing with other trades; structure; existing and new utilities, ductwork, piping; and other existing conditions as required for a complete, conflict free installation.
   b. Coordinate site routing with other trades; structure; new and existing buried utilities, new and existing paved areas, conduit sleeves, and landscaping before digging to avoid conflicts, damage, and to allow for future installations.
3. Route raceway parallel and perpendicular to walls, floors, and ceilings.
4. Route exposed conduit parallel to structural elements. Follow all surface contours; do not route in free air from point to point. Where physically possible, install on top side of structural elements to conceal from view. Paint to match structure to which it is attached.
5. Route conduit in and under slab from point-to-point. Coordinate conduit installations in slab, except straight slab penetrations with structural engineer for conduits larger than 2”.
6. Maintain clearance between raceway and piping for maintenance purposes.
7. Maintain 12 inch clearance between power raceways and communications cabling, raceways, and cable trays.
8. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
9. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Use factory
elbows or hydraulic one-shot bender to fabricate elbows for bends in metal conduit larger than 2 inch size.

C. Install raceways so that it drains to junction and pull boxes to avoid moisture traps at low points; install junction box with drain fitting at low points in conduit system.

D. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

E. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

F. Close ends and unused openings in surface raceways, wireways, boxes, and enclosures.

G. Maximum Size Conduit in Slab Above Grade: 3/4 inch. Do not cross conduits in slab without approval.

H. Cut conduit square using saw or pipe cutter; de-burr cut ends.

I. Bring conduit to shoulder of fittings; fasten securely.

J. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

K. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

L. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

M. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

N. All connections to motors, instruments, machines, and equipment subject to movement or vibration shall be made using liquid-tight flexible metal conduit (3ft max).

3.5 INSTALLATION – BOXES, ENCLOSURES, CABINETS

A. General Requirements
   1. Seal all unused openings.
   2. Provide flush mounted boxes in finished areas.
   4. Install boxes without damaging or removing insulation, cutting structural elements, or damaging finishes.
   5. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

B. Wiring Device Boxes
1. Install gang box where more than one device is mounted together. Do not use sectional box.
2. Install gang box with plaster ring for single device outlets.
3. Adjust mounting locations to be flush with finished surface.
5. Do not install flush mounting box back-to-back in walls
   a. Install with minimum 6 inches separation.
   b. Install in separate stud bays to reduce noise transfer where ever possible.
   c. Install with minimum 24 inches separation in acoustic rated walls.
6. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings. Refer to architectural elevations for mounting heights of outlet boxes noted “above counter.”
7. Orient boxes to accommodate wiring device orientation. Field verify with architect for wiring devices mounted above counters or exposed to view in lobbies, on display walls, etc.
8. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Ceiling Mounted Boxes
   1. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
   2. Install adjustable steel channel fasteners for hung ceiling outlet box.
   3. Do not fasten boxes to ceiling support wires or other piping systems.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with the fire stopping material manufacture’s instructions.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation. Follow architectural details for any required roof penetrations. Obtain permission from architect for dedicated electrical rough penetrations before performing work.

C. Locate outlet boxes to allow luminaires positioned as indicated on reflected ceiling plan.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.7 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

3.8 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.
B. Clean exposed surfaces and restore finish.

END OF SECTION
SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Labels.
   3. Wire markers.
   5. Stencils.
   7. Lockout Devices.
   8. Operating Instructions
   9. Nameplates
   10. Warning Signs

1.2 SUBMITTALS

A. Product Data:
   1. Submit manufacturer’s catalog literature for each product required.
   2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

B. Manufacturer’s Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with state and federal codes.

B. Provide all labeling as required by NFPA 70 and 70E.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept identification products on site in original containers. Inspect for damage.
B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.

B. Letter Size:
   1. 1/4 inch high (min) letters for identifying individual equipment and loads.
   2. 1/4 inch high (min) letters for identifying grouped equipment and loads.

C. Minimum nameplate thickness: 1/8 inch.

2.2 WIRE MARKERS

A. Description: Cloth tape, split sleeve, or tubing type wire markers.

B. Legend:
   1. Power and Lighting Circuits: Panel name and branch circuit or feeder number.
   2. Control Circuits: Control wire number as indicated on shop drawings.

2.3 UNDERGROUND WARNING TAPE

A. Description: 6 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

2.4 LOCKOUT DEVICES

A. Lockout Hasps:
   1. Anodized aluminum or Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

2.5 POSTED OPERATING INSTRUCTIONS

A. Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:
1. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
2. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
3. Safety precautions.
4. The procedure in the event of equipment failure.
5. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

B. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

2.6 MANUFACTURER'S NAMEPLATE

A. Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.7 FIELD FABRICATED NAMEPLATES

A. ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.8 ARC FLASH HAZARD IDENTIFICATION

A. Arc Flash Warning Labels: Per ANSI Z535.4, the signal word WARNING appearing in black letters on an orange background, with second line below (Arch Flash and Shock Hazard) in black letters on white background and third line below (Appropriate PPE required) in black letters on white background.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of painting.

B. Provide each panel with a manufacturer prepared arc flash hazard warning label.
C. Provide a typed panel directory for each panel provided or modified for this project. Directory shall identify the circuit number, loads served, and location of loads by room number. Mount on inside of each panel and file with the owner when the work is complete.

D. Nameplate Installation:
   1. Install nameplate parallel to equipment lines.
   2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners.
   3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners.
   4. Secure nameplate to equipment front using screws or rivets.
   5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
   6. Install nameplates for the following:
      a. Panelboards.
      b. Disconnects and starters.
      c. Lighting contactors
      d. Equipment enclosures
      e. Controls cabinets and enclosures

E. Label Installation:
   1. Install label parallel to equipment lines.
   2. Install label for identification of individual control device stations.
   3. Install labels for permanent adhesion and seal with clear lacquer.
   4. Install panel name and circuit number identification labels for the following:
      a. Junction boxes (permanent marker may be used for junction boxes in mechanical spaces or above lay in ceilings.)
      b. Receptacle cover plates

F. Wire Marker Installation:
   1. Install wire marker for each conductor at panelboards, gutters, pull boxes, at electrical equipment such as contactors and disconnects, and each load connection.
   2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
   3. Install labels at data outlets identifying patch panel and port designation.

G. Raceway Marker Installation:
   1. Install raceway marker for each raceway longer than 6 feet and rated 100A or more.
   2. Raceway Marker Spacing: provide marker in a visible location in each room where raceway passes through walls or floors.
   3. Coordinate with architect before labeling raceways in finished spaces

H. Junction and Pull Box Installation
   1. Label all junction boxes with the panel, circuit number, and voltage. For boxes exposed in finished spaces, label the inside of the cover.
   2. Box for communications, fire alarm, and access control shall be provided with color coded covers. Coordinate color to be used with owner.

I. Underground Warning Tape Installation:
1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION
SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes
   1. Branch circuit panelboards,

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:
   1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
   2. NEMA FU 1 - Low Voltage Cartridge Fuses.
   3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
   4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
   5. NEMA PB 1 - Panelboards.
   6. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

C. International Electrical Testing Association:

D. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

E. Underwriters Laboratories Inc.:
   1. UL 67 - Safety for Panelboards.
   2. UL 1283 - Electromagnetic Interference Filters.
   3. UL 1449 - Transient Voltage Surge Suppressors.

F. Uniform General Conditions, including Supplementary General Conditions.

G. Division 1 – General Requirements, Section 01000 – Special Conditions.

1.3 SUBMITTALS

A. Shop Drawings: Manufacturer or contractor prepared drawings showing all relevant dimensions, weights, mounting requirements, and conduit entry points.
   1. Include dimensioned plan views and elevations.
B. Product Data: Submit catalog data showing all standard features, dimensions, weights, listings and product labels, material types, finishes and clearly indicating which optional features will be provided.
   1. Include amperage ratings, voltage, over-current protective device ratings, AIC ratings.
   2. Where multiple sizes are listed, indicate sizes to be used.
   3. Where multiple products are shown on the same page, indicate which products to be used.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of electrical equipment and record actual circuiting arrangements.

B. Operation and Maintenance Data:
   1. Provide product data as defined under submittals.
   2. Provide manufacturer's installation and maintenance instructions for normal operation, routine maintenance and testing, and emergency maintenance procedures.
   3. Submit spare parts listing; source of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
   1. Manufacturer shall maintain or certify an independently operated service center capable of providing training, support, parts, and maintenance services.

B. Supplier: Authorized distributor

C. Installer: A licensed electrician with documented experience installing all equipment specified here in shall directly supervise all work. Where noted in the specifications or required by the manufacturer, installer shall be a manufacturer trained and/or certified installer of the specific product to be installed.

1.6 QUALITY ASSURANCE

A. Source Limitations: All components required for a complete functioning system as described here in shall be obtained through one source from a single manufacturer.

B. Listing and Labeling: Where required, all electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for the intended use. Testing agency shall be UL unless noted otherwise or pre-approved by owner and AHJ.

1.7 WARRANTY

A. Provide manufacturer's standard form clearly stating that manufacturer agrees to repair or replace equipment, materials, and associated auxiliary components that fail or deteriorate within the specified warranty period.
B. Warranty Period: one(1) year from the date of substantial completion

1.8 DELIVERY STORAGE AND HANDLING

A. Store in clean, dry space located above grade and protect from dirt, water, construction debris, traffic, freeze, and where applicable, deterioration from sunlight.

B. Maintain factory wrapping or provide additional canvas or plastic cover for all large electrical equipment. Follow all manufacturer recommendations for humidity and max/min temperatures for storing electrical equipment.

1.9 MAINTENANCE MATERIALS

A. Furnish four of each panelboard key. Panelboards keyed alike.

PART 2 PRODUCTS

2.1 BRANCH CIRCUIT PANELBOARDS

A. Manufacturers:
   1. Cutler Hammer
   2. General Electrical
   3. Siemens
   4. Square D
   5. Substitutions: With engineer approval.

B. Product Description: NEMA PB 1, circuit breaker type, lighting and appliance branch circuit panelboard. Load center type panelboards are acceptable for panelboards rated for less than 100A.

C. Panelboard Bus:
   1. Copper current carrying components, ratings as indicated on Drawings.
   2. Furnish copper ground bus in each panelboard.
   3. Furnish fully rated copper neutral bus in each panelboard.

D. Minimum Integrated Short Circuit Rating: 10KAIC unless higher value indicated on Drawings.

E. Molded Case Circuit Breakers: NEMA AB 1, plug-in type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as:
   1. Type SWD for lighting circuits.
   2. Type HACR for air conditioning equipment circuits.
   3. Class A ground fault interrupter circuit breakers as indicated on Drawings.
   4. UL 1699 compliant arc flash circuit interrupter for all circuits serving receptacles in every room of dwelling units.
   5. Do not use tandem circuit breakers.

F. Enclosure: NEMA PB 1, Type 1 or Type 3R unless noted otherwise
1. 6 inches deep, 20 inches wide.
2. Cover: Flush cabinet front with continuous hinge.
3. Door: continuous hinge, metal directory frame, and flush lock keyed alike.
4. Finish in manufacturer's standard gray enamel except as noted in 5 and 6.
5. For panels on building exteriors in visible locations, paint to match surface to which they are attached.

2.2 LOAD CENTERS

A. Manufacturers:
   1. Cutler Hammer
   2. General Electrical
   3. Siemens
   4. Square D
   5. Substitutions: With engineer approval.

B. Description: Circuit breaker load center, with bus ratings as indicated on Drawings.

C. Performance:
   1. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical.

D. Materials:
   1. Molded Case Circuit Breakers: UL 489, plug-on type thermal magnetic trip circuit breakers, with common trip handle for poles, listed as Type SWD for lighting circuits, Class A ground fault interrupter circuit breakers as indicated on drawings. Do not use tandem circuit breakers.
   2. Enclosure: General Purpose

E. Box: Flush type with door, and pull ring and latch lock on door.
   1. Finish in manufacturer's standard gray enamel.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect abandoned panelboards and remove.

3.2 INSTALLATION

A. Install panelboards:
   1. In accordance with NEMA PB 1.1.
   2. Plumb with adjacent walls and supports.
   3. Flush with wall finishes if recessed in wall.
   4. By securing all four corners to the adjacent structure using appropriate supports.
   5. On concrete pads if floor mounted.

B. Provide each panel with:
   1. Filler plates for unused spaces in panelboards.
2. Typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.

3. Engraved plastic nameplates identifying panel name, source, amperage, and voltage.

C. Mounting Requirements
1. Exterior Free Standing: Mount to galvanized u-channel rack with minimum of two (2) horizontal supports behind panel and one (1) horizontal support below panel to secure conduits. Vertical supports shall be imbedded in concrete foundation or bolted to concrete pad. If bolted to pad, provide 45 degree angle braces attached to vertical support one foot or more above pad.

2. Mounting Height:
   a. Interior Spaces: 6 feet to top of panelboard.
   b. Install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
   c. Exterior: To help shield from view, mount panels as low as practical. Bottom of panel shall be at least 18” AFG unless floor mounted or mounted over concrete, asphalt, etc.

D. Grounding
1. Ground and bond panelboard enclosure according to grounding specifications and code. 
2. Connect equipment ground bars of panels in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. Tighten all accessible electrical connections to the manufacturer's torque specifications.

B. Remove all blocks, packing and shipping materials, and foreign materials.

C. Manually exercise all switches, circuit breakers, and other operating mechanisms to make certain they operate freely.

D. Check integrity of all electrical and mechanical interlocks and padlocking mechanisms.

E. Conduct an insulation resistance test phase to ground and phase to phase with the OCPDs in both the open and closed position. Resistance in open position shall be 1 megohm min. Remediate and retest if resistance is less. Verify that any metering or surge protection equipment that could be damaged by this testing has been disconnected and or removed as needed for testing.

F. Test all ground fault protection systems in accordance with the manufacturer's instructions.

3.4 ADJUSTING

A. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
END OF SECTION
SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes
   1. Wall switches
   2. Wall dimmers
   3. Receptacles
   4. Terminal strips
   5. Device plates and decorative box covers.
   6. Lighting contactors
   7. Occupancy sensors
   8. Photocells (Daylight sensors)
   9. Relays
   10. Push button and selector switches

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

B. Uniform General Conditions, including Supplementary General Conditions.

C. Division 1 – General Requirements, Section 01000 – Special Conditions.

1.3 SUBMITTALS

A. Product Data: Submit catalog data showing all standard features, dimensions, weights, listings and product labels, material types, finishes and clearly indicating which optional features will be provided.
   1. Include amperage and voltage ratings.
   2. Include color to be used for
   3. Where multiple sizes are listed, indicate sizes to be used.
   4. Where multiple products are shown on the same page, indicate which products to be used.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of each floor box and poke-through fitting.

B. Operation and Maintenance Data:
   1. Provide product data as defined under submittals.
2. Provide manufacturer’s installation and maintenance instructions for normal operation, routine maintenance and testing, and emergency maintenance procedures.
3. Submit spare parts listing; source of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Supplier: Authorized distributor

C. Installer: A licensed electrician with documented experience installing all equipment specified here in shall directly supervise all work. Where noted in the specifications or required by the manufacturer, installer shall be a manufacturer trained and/or certified installer of the specific product to be installed.

1.6 QUALITY ASSURANCE

A. Source Limitations: All components required for a complete functioning system as described here in shall be obtained through one source from a single manufacturer.

B. Listing and Labeling: Where required, all electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for the intended use. Testing agency shall be UL unless noted otherwise or pre-approved by owner and AHJ.

1.7 WARRANTY

A. Warranty Period: one(1) year from the date of substantial completion

PART 2 PRODUCTS

2.1 STANDARD LINE VOLTAGE WALL SWITCHES

A. Manufacturers:
   1. Cooper Wiring Devices
   2. Harvey Hubbell, Inc.
   3. Leviton Manufacturing Company.
   4. Substitutions: With engineer approval.

B. Product Description:
   1. NEMA WD 1, General-Duty, commercial grade, AC only general-use snap switch, unless noted otherwise
2. Provide heavy duty industrial grade switches in janitor’s closet, mechanical rooms, manufacturing areas, and labs.
3. One-piece brass integral ground terminal

C. Ratings:
   1. Voltage: 120-277 volts, AC.
   3. 1HP-120V, 2HP 240-277V

D. Body and Handle:
   1. White nylon
   2. Provide toggle switches in finished areas.
   3. Provide toggle switches in unfinished areas such as janitor’s closet, mechanical rooms, manufacturing areas, and labs.

E. DIGITAL WALL SWITCHES
   1. Low voltage momentary pushbutton switches in 4 button configuration; available in white; compatible with wall plates. Wall switches shall include the following features:
   2. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
   3. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
   4. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.

2.2 RECEPTACLES

A. Manufacturers:
   1. Cooper Wiring Devices
   2. Harvey Hubbell, Inc.
   3. Leviton Manufacturing Company.
   4. Substitutions: With engineer approval.

B. Product Description:
   1. NEMA WD 1, Heavy-duty, commercial grade receptacle, unless noted otherwise.
   2. Provide heavy duty industrial grade receptacles in janitor’s closets, mechanical rooms, manufacturing areas, and labs.
   3. One-piece brass integral ground straps
   4. Ground retention clips
   5. Back wired ground terminals
   6. Face and body: Constantly on – white nylon
   7. Face and body: Switched by occupancy sensing device – grey nylon
   8. All receptacles shall be tamper resistant.
C. Minimum rating: 20A, 125V

D. Configuration: NEMA WD 6, type as indicated on Drawings.

E. Convenience Receptacle:
   1. Type 5-20, unless noted otherwise
   2. 2 pole, 3 wire grounding

F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.3 WALL PLATES

A. Manufacturers:
   1. Provide product by the manufacturer of the wiring device being covers by the wall plate

B. Decorative Cover Plate: nylon to match receptacle color above.

C. Weatherproof Cover Plate: Stainless steel plate with gasketed device cover.

2.4 OCCUPANCY SENSOR

A. Manufacturers:
   1. Cooper
   2. Douglas Lighting Controls
   3. Hubbell
   4. Leviton
   5. Lutron
   6. Watt Stopper
   7. Substitutions: With engineer approval.

B. Product Description:
   1. Devices shall include both infrared and ultrasonic sensing (elsewhere noted dual technology or multi-technology)
   2. Separate sensitivity and time delay adjustments with LED indication of sensed movement. User adjustable time-delay: 30 seconds to 30 minutes.
   3. Operation shall be silent.
   4. Integral daylight sensing with automatic shutoff at field adjustable light level.
   5. 1000VA at 120V, 2700VA at 277V rated
   6. 2000 sq ft coverage area.
      a. 1000 sq ft coverage may be used for room 800 sq ft or less, except restrooms and cubicle areas.
      b. 500 sq ft or less coverage devices shall not be used.
   c. Ceiling mounted sensors
      d. 360 degree sensing, unless noted 180 degree.
      e. Ultrasonic sensors on both side of device, unless noted 180 degree.
f. Device shall be capable of being wired in parallel with additional occupancy sensors for large spaces.

7. Wall mounted sensors
   a. Integral on/off pushbutton
   b. 180 degree sensing

C. Programming
   1. Set off delay to 15 minutes minimum.
   2. Set off delay to 30 minutes in open office areas and restrooms.
   3. Start in the morning and periodically check light levels throughout the day. Set daylight sensing automatic shutoff at the time when and if 40FCs are first measured at 36 inches above floor in the area controlled by the sensor.
   4. Set daylight sensing as follows: switch lighting off, temporarily set off-delay to 0, verify adequate foot-candle levels, switch lighting on, and adjust dial until lights switch off
   5. Any lighting within the space that is not controlled by the sensor should remain on throughout the programming process.
   6. More detail procedures for daylight sensor programming are required when daylight controls are used for selective switching of specific lights within a space that are located near sources of daylight. The procedures described here apply to whole room occupancy sensors only.

D. Dual Relay devices:
   1. Where occupancy sensors are indicated on the architectural, mechanical, or electrical plans to control additional equipment (exhaust fans, outside air dampers, etc), provide sensor with a second dedicated relay with appropriate voltage and power rating for the equipment to be served.
   2. Electrical contractor shall coordinate with GC, mechanical contractor, and controls contractors to determine all locations where dual relays are required and insure the appropriate model device is ordered.

2.5 PHOTOCELLS (DAYLIGHT SENSORS)

A. Manufacturers:
   1. Cooper
   2. Douglas Lighting Controls
   3. Hubbell
   4. Leviton
   5. Lutron
   6. Watt Stopper
   7. Substitutions: With engineer approval.

B. Product Description:
   1. Photoelectric light level sensor
   2. Separate sensitivity and time delay adjustments. User adjustable time-delay: 30 seconds to 30 minutes.
   3. Operation shall be silent.
   4. 1000VA at 120V, 2700VA at 277V rated
5. 2000 sq ft coverage area.
   a. 1000 sq ft coverage may be used for room 800 sq ft or less, except restrooms and cubicle areas.
   b. 500 sq ft or less coverage devices shall not be used.
6. Device shall be capable of being wired in parallel with additional sensors for large spaces.

C. Sensor Devices: Each sensor employs photo diode technology to allow linear response to daylight within illuminance range.
   1. Exterior Lighting: Hooded sensor, horizontally mounted, employing flat lens, and working range 1-100 foot-candles in 10 percent increments.
      Entire sensor encased in optically clear epoxy resin.
   2. Indoor Lighting: Sensor with Fresnel lens providing for 60 degree cone shaped response area to monitor indoor office lighting levels.
   3. Atriums: Sensor with translucent dome with 180 degree field of view and respond in range of 10-1,000 foot-candles.
   4. Skylights: Sensor with translucent dome with 180 degree field of view and respond in range of 10-1,000 foot-candles.

D. Programming for On/Off Daylight Control
   1. Set off delay to 0 for programming, but adjust to 15 minutes after programming to avoid nuisance operation of the device.
   2. Any lighting within the space that is not controlled by the sensor should remain on throughout the programming process.
   3. At mid-day on a cloudless day, verify with a light meter that the required foot-candle levels are measured at the required location for each space with the lighting to be controlled by the sensor off.
   4. If the required light levels are not present, instruct owner in the procedure for setting the device and advise owner to repeat programming effort the following August.
   5. If required light levels are present, periodically check light levels on the following day, starting in the early morning, and program sensor when the required light levels first appear.
   6. Turn lighting on and adjust dial until lights switch off.
   7. Set office and work area sensor as follows
      a. Offices: 40FC measured at the working surface when the lighting controlled by the sensor is off.
      b. Open Offices: 40FC measured at the working surface of the cubicle furthest from the source of daylight (i.e. windows) and located between the source of daylight and the first row of lights not controlled by the daylight sensor.
   8. Set sensors in other locations by measuring the following levels at floor level along the centerline of the space between the wall transmitting daylight and the outside edge of the first row of lights that will remain on after the daylight sensor controlled lights are switched off.
      a. Restrooms: 20FC
PART 3 EXECUTION

3.1 EXAMINATION

A. Verify outlet boxes are installed at proper height.
B. Verify wall openings are neatly cut and completely covered by wall plates.
C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
D. Verify locations of floor boxes and outlets prior to rough in

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 EXISTING WORK

A. Disconnect and remove abandoned wiring devices.
B. Modify installation to maintain access to existing wiring devices to remain active.
C. Clean and repair existing wiring devices to remain or to be reinstalled.
D. Maintain access to existing floor boxes remaining active and requiring access. Modify installation or provide access panel.

3.4 INSTALLATION

A. Install devices plumb and level.
B. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
C. Install boxes and fittings to preserve fire resistance rating of slabs and other elements
D. Connect wiring devices by wrapping solid conductor around screw terminal.
   1. Install stranded conductor for branch circuits 10 AWG and smaller.
   2. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations.
   3. Do not place bare stranded conductors directly under device screws.
E. Wall Plates
   1. Install wall plates on flush mounted switches, receptacles, and blank outlets.
   2. Install decorative plates with concealed screws on switches, receptacles, and blank outlets in finished areas.
3. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
4. Use jumbo size plates for outlets installed in masonry walls.

F. Switches
1. Install switches with OFF position down.
2. Where multiple switches are installed at the same location, switches shall be ganged together.

G. Receptacles
1. Install receptacles with grounding pole on top.
2. Provide appropriate receptacle type for the application per the requirements listed in part 2 above.

H. Occupancy and photo sensors
1. Install ceiling mounted devices in center of area to be covered.
2. Install wall mounted devices at the typical switch location unless gimbal mounted.
3. Install gimbal mounted wall switches at 18" below ceiling.
4. Install 180 degree ceiling mounted devices at locations that are exposed to adjacent spaces from which false on signals could come.
5. Install gimbal mounted and 180 degree ceiling devices at edge of space facing towards the area to be covered and away from adjacent spaces from which false on signals could come.

3.5 INTERFACE WITH OTHER PRODUCTS
A. Coordinate locations of outlet boxes with furniture and equipment.
B. Install wall switch 48 inches above finished floor.
C. Install convenience receptacle 18 inches above finished floor.

3.6 FIELD QUALITY CONTROL
A. Inspect each wiring device for defects.
B. Operate each wall switch and occupancy sensor with circuit energized and verify proper operation.
C. Verify each receptacle device is energized.
D. Test each receptacle device for proper polarity.
E. Test each GFCI receptacle device for proper operation.
3.7 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust floor box flush with finish flooring material

3.8 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

B. Clean interior of boxes to remove dust, debris, and other material.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes luminaires, lamps, ballasts, and accessories.

1.2 REFERENCES

A. Uniform General Conditions, including Supplementary General Conditions.

B. Division 1 – General Requirements, Section 01000 – Special Conditions.

1.3 SUBMITTALS

A. Shop Drawings: Indicate dimensions and components for each luminaire not standard product of manufacturer.

B. Product Data: Submit catalog data showing all standard features, dimensions, listings and product labels, material types, finishes and clearly indicating which optional features will be provided.

1. Ballast and lamp information.

2. Include photometric data

3. Where multiple sizes are listed, indicate sizes to be used.

4. Where multiple products are shown on the same page, indicate which products to be used.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1. Manufacturer shall maintain or certify an independently operated service center capable of providing training, support, parts, and maintenance services.

B. Supplier: Authorized distributor

C. Installer: A State of Texas licensed electrician with documented experience installing all equipment specified here in shall directly supervise all work.

1.5 QUALITY ASSURANCE

A. Source Limitations: All components required for a complete functioning luminaire as described here in shall be obtained through one source from a single manufacturer.

B. Listing and Labeling: Where required, all electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency
acceptable to authorities having jurisdiction and marked for the intended use. Testing agency shall be UL unless noted otherwise or pre-approved by owner and AHJ.

1.6 WARRANTY

A. Provide manufacturer’s standard form clearly stating that manufacturer agrees to repair or replace equipment, materials, and associated auxiliary components that fail or deteriorate within the specified warranty period.

B. Warranty Period:
   1. One(1) year from the date of substantial completion for luminaires
   2. Five(5) years from the date of substantial completion for all ballasts.

1.7 DELIVERY STORAGE AND HANDLING

A. Store in clean, dry space located above grade and protect from dirt, water, construction debris, traffic, freeze, and where applicable, deterioration from sunlight.

B. Maintain factory wrapping or provide additional canvas or plastic cover. Follow all manufacturer recommendations for humidity and max/min temperatures for storing.

1.8 MAINTENANCE MATERIALS

A. Furnish two of each plastic lens type.

PART 2 PRODUCTS

2.1 LUMINAIRES

A. Manufacturers:
   1. Manufacturers shall be as listed in the luminaire schedule
   2. Substitutions: With engineer approval.

B. Product Description: Complete luminaire assemblies, with features, options, and accessories as scheduled.

2.2 LED Drivers

A. Product Description:
   1. LED power supplies shall operate LEDs within the current limit specification of the manufacturer
   2. 60Hz input source
   3. input power factor >90%
   4. minimum efficiency of 70% at full rated load of the driver
   5. Minimum starting temperature of 0°F
   6. Maximum case temperature rating of at least 70°C
   7. Power supply output regulated to +/-5% across published load range
   8. Class A sound rating
Compliant with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47CFR part 15, non-consumer (Class A) for EMI/RFI B

3 year minimum warranty from date of Substantial Completion against defects in material or workmanship, including a replacement, for operation at or below the maximum case temperature specification. (For LED lamps and internal power regulation components for defects resulting in a fixture lumen depreciation >30%.)

Dimmable power supplies shall allow the light output to be maintained at the lowest control setting (prior to off) without dropping out

No PCBs

2.3 LED Lamps and Luminaires

A. Manufacturers
   1. Lamps:
      a. Philips
      b. Substitutions: With engineer approval.
   2. Luminaire Manufacturers shall
      a. provide the manufacturer’s name of the LED being used in the luminaire
      b. meet DOE’s Energy Star or Design Light Consortium performance criteria
      c. registered as a DOE Quality Advocate

B. Product Description
   1. 50,000 hour rated
   2. Minimum CRI 80
   3. The CCT shall be 3000K unless noted otherwise
   4. total harmonic distortion (THD) <10%
   5. power factor ≥90%
   6. Shall be tested in accordance with LM-79-08 electrical and photometric measurements. Provide to the owner test results of each unique lamp.
   7. LED light source packages, arrays or modules used in the luminaire shall be tested in accordance with LM-80 lumen depreciation test. Provide to the owner, test results of each unique package, array or module. The L70 rated life result shall be a minimum of 50,000 hours
   8. Luminaires shall be UL, or ETL, listed and be furnished complete with LEDs and power supplies
   9. Minimum 3 year warranty covering all components.

C. Screw in Retrofit LED Lamps
   1. Retrofit LEDs shall follow all applicable product descriptions under B.
   2. Shall meet DOE’s Energy Star or Design Light Consortium performance criteria for qualified screw-in or pin-based LED lamps
   3. Shall have Lamp CCTs conforming to ANSI C78.377A color binning and utilize a 4 step MacAdam Ellipse Algorithm binning process (Philips Optibin or equal) within each retrofit lamp for greater CCT consistency
   4. Each lamp shall have total harmonic distortion (THD) <10%
   5. Shall be tested in accordance with LM-80 lumen depreciation test. Provide to the owner test results of each unique lamp. The L70 rated life result shall be a minimum of 25,000 hours for MR11, 16 and candelabra lamps; 40,000 hours for PAR 20, 30, 38 and BR30 lamps
PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned luminaires, lamps, and accessories.

B. Extend existing interior luminaire installations using materials and methods compatible with existing installations.

C. Clean and repair existing interior luminaires to remain or to be reinstalled.

3.2 PREINSTALLATION COORDINATION

A. Refer to architectural reflected ceiling plan for exact light fixture locations.

B. Examine the area of installation to verify adequate space and mounting provisions are provided for the specified luminaire prior to order luminaires.

C. Verify that luminaires will not interfere with required clearances for equipment such as HVAC equipment filter removal clearance, NEC working space in front of HVAC equipment control panels, etc.

D. Coordinate location of exit lights with structure and other MEP systems to insure that exit signs are clearly visible.

3.3 INSTALLATION

A. Lighting Conductors and Conduit
   1. Provide ground wire and one neutral conductor per circuit in all lighting conduit.
   2. All conductors serving luminaires shall be routed in conduit.
   3. Luminare whips may be flexible metal conduit up to 6ft. Secure to structure with listed supports.
   4. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

B. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.

C. Install luminaires plumb, square, and level and aligned with ceilings, walls, and with each other and secure per manufacturer’s printed instructions.

D. Recessed Luminaire Requirements
   1. Install recessed luminaires to permit removal from below.
   2. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
   3. Install clips to secure recessed grid-supported luminaires in place.

E. Install wall-mounted luminaires at height as indicated on drawings

F. Install accessories furnished with each luminaire.

G. Install specified lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.5 ADJUSTING

A. Aim and adjust luminaires.

B. Position exit sign directional arrows as indicated on Drawings.

3.6 CLEANING

A. Remove dirt and debris from enclosures.

B. Clean photometric control surfaces as recommended by manufacturer.

C. Clean finishes and touch up damage.

3.7 PROTECTION OF FINISHED WORK

A. Relamp luminaires having failed lamps at Substantial Completion.

END OF SECTION